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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XIII DECEMBER 15, 1924 NUMBER 21

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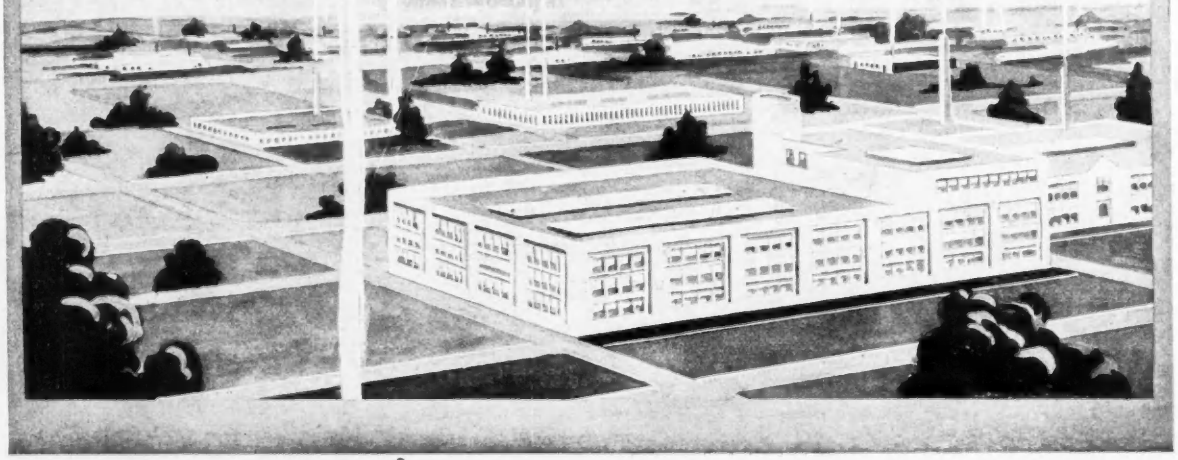

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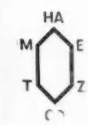

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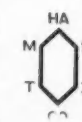

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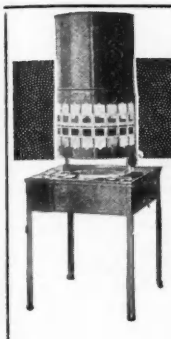

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VOLUME XIII NEW YORK, DECEMBER 15, 1924 NUMBER 21

The Application of Vat Dyes to Wool

Suitable Vat Dyes for Wool—Preparation of the Stock Vat—Preparation of the Dye Vat—Formulas—Combination of Vat Dyes

By CHAS. E. MULLIN, F. A. I. C.

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[NOTE.—*The author is indebted to Henry J. Bogan of H. A. Metz & Co. for much data contained in this article. It is, of course, understood that all dyeing formulas given are largely based on laboratory work and will require changes in use according to the actual conditions encountered.*]

WHILE indigo has quite a wide use in wool raw stock dyeing, the other vat dyes do not appear to have much use upon wool in America. However, from some of the recent German color cards and publications, it appears that considerable progress has been made in Europe in the application of vat dyes of the indigo class to wool raw stock and slubbing, and that they are experimenting with piece goods dyeing and printing with vat dyes also.

Vat dyeing of wool with indigo is one of the oldest known dyeing processes, and the application of vats to cotton is now such a familiar process that, considering their advantages, it is surprising that their application to wool is not more common in America. It is claimed that in many cases the application of vat dyes, by means of the hydrosulphite vat, is just as easy and more certain than dyeing by the mordant process.

The indigo group vat dyes have a high affinity for wool and good fastness, but vats of the Indanthrene series, or anthracene derivatives, have little affinity for wool and do not appear to have been used in this way. The following dyes are possibly most suitable for application to wool, and most of them are recommended by their manufacturers for this purpose:

Helindone Khaki C Vat
Helindone Brown C3R Vat and Grains
Helindone Brown CMR Vat
Helindone Brown CM Powder, Vat and Grains
Helindone Red CR Vat and Grains
Helindone Red 2B Vat and Grains
Helindone Black B Vat and Grains
Helindone Black 3B Vat
Helindone Black T Vat and Grains
Helindone Yellow CG Powder, Paste and Vat
Helindone Yellow CA Powder, Paste and Vat
Helindone Orange R Powder and Paste
Helindone Pink BN Powder and Paste
Helindone Fast Scarlet C Powder and Paste
Helindone Violet B Powder and Paste
Helindone Blue 3G Powder
Helindone Gray 2B Powder and Paste
Helindone B Vat
Helindone 3B Vat

Hydron Wool Yellow G Vat
Hydron Wool Brown G Vat
Hydron Wool Brown D Vat
Hydron Wool Olive B Vat
Hydron Wool Red BB Vat
Hydron Pink FF Powder and Paste
Hydron Pink FB Powder and Paste
Hydron Orange R Powder and Paste
Hydron Scarlet BB Powder and Paste
Hydron Scarlet 3B Powder and Paste

Sulfanthrene Pink FF Paste
Sulfanthrene Blue GR Paste

Du Pont Indigo 20 per cent Paste

Indigo MLB Powder
Indigo MLB Little Lumps
Indigo MLB Paste
Indigo MLB Vat I
Indigo MLB R
Indigo MLB 2B
Indigo MLB 4B

You will notice that most of these dyes are available in more than one form or condition, i. e., "powder," "paste," "vat" and "grains." We are all familiar with the vat dyes in powder and paste forms, but the "vat" and "grain" forms are newer. The term "vat" signifies

that the dyestuff is in paste form and in the reduced or leuco condition. The term "grains" is newer, and is in fact the very latest form in which the vat dyes are available. It means that the dyestuff is in the reduced or leuco condition, exactly the same as the "vat" form, but it is in the physical form of small dried grains, and usually about five times as concentrated as the "vat" form. Both the "vat" and "grains" forms contain all constituents necessary and in sufficient quantity for complete solution in the corrected water of the dye-vat, directly, without the preliminary preparation of the "stock-vat" as is necessary for the "powder" and "paste" forms of the dyestuff.

It has been stated that the vat and grains forms of the leuco dyestuff as now on the market are neutral and not alkaline, but contain some dissolving substance which renders the use of caustic alkalis in the "vat" and "grains" unnecessary. A. E. Woodhead, in a recent article in the Journal of the Society of Dyers and Colourists, 40, 74-7 (1924), entitled "Colour Solvents and Their Application to Textile Fibers," discusses the use of various dye solvents, and it may be possible that some compound of this kind has been incorporated in the "vat" and "grains" forms of the dyes as they are now marketed.

It has been stated that the solvent products known as neomerpin and tetracarnite may be used to assist in vat dyeing; that they assist in securing level dyeings by aiding in wetting out, and reduce the amount of hydrosulphite required, possibly by assisting in the rapid and complete wetting out of the dye particles themselves.

A study of the properties of the vat dyes will readily show their advantages in many respects for wool dyeing. While the cost of the actual dyestuff is higher than the cost of the mordant dyestuff it replaces, the saving in mordant, labor, heat, water and time will often materially reduce this apparent increased cost of dyeing. Furthermore, the harshness of the mordant dyed wool, due to the presence of the metallic mordant and the long boiling necessary to apply the mordant dyestuffs, is altogether avoided. With vat dyestuffs, the dyeing of light shades is usually complete in 20 to 45 minutes, and therefore the capacity of the dyeing machines and whole dyehouse is very materially increased, with a consequent cut in labor and overhead costs. As the dyeing temperature is usually below 60 deg. Cent. (140 deg. Fahr.), and always below 75 deg. Cent. (167 deg. Fahr.), the saving of fuel is no small item for consideration.

As compared with acid dyes, the cost of the vat dyes are generally higher, but their superior fastness must also be considered and for special purposes, such as a dark wool stripe effect on a white or light wool ground, this added fastness may well warrant the additional expense. Further, in many cases, where the weight of stock used in the stripe is comparatively small as compared with the total weight of stock used, the actual increase in cost on a yardage basis may be very small, and the elimination of seconds due to bleeding or fading during wet finishing, bleaching, etc., may more than offset the increased cost. The actual cost of the vat dyestuff used is usually between 10 to 25 cents per pound of stock dyed, and in blacks of full shade, such as uniform cloths, the cost is usually not more than 18 to 20 cents per pound of stock dyed.

Some spinners state that they are able to spin the same grade of raw stock to considerably higher counts of yarn when it is vat dyed than when it is mordant dyed. For this reason some spinners blend in, say, 40 per cent of vat dyed stock with the chrome dyed stock, before spinning, in order to get yarns of higher counts from low grade stock. It is claimed that this is now a common practice in some European mills.

Preparation of the Stock Vat

Indigo and certain vat dyes are readily reduced in an alkaline solution by hydrosulphite to a soluble condition. As the reaction takes place best in a concentrated solution, in preparing the stock vat the dye in powder or paste form is usually first mixed to a very thin solution or paste with caustic soda solution, hydrosulphite solution, water and either Turkey Red Oil or Monopole soap, and reduced at about 60 deg. Cent. (140 deg. Fahr.) by the gradual addition of the powdered hydrosulphite. When reduction is complete, i. e., when the solution is clear and the color of the leuco-dye compound, the stock vat is ready for use. Unreduced dyestuff calls for the addition of more hydrosulphite and a cloudy solution for more caustic, the various dyestuffs requiring different amounts of hydrosulphite and caustic, as shown by Table 1, published by courtesy of H. A. Metz & Co.

Preparation of the Dye Vat

The dye vat is usually prepared by the addition of a small quantity of hydrosulphite and sufficient ammonium hydroxide to correct the water, and to give a slight pink color with phenolphthalein solution, which color should disappear on long stirring. Glue is widely used in the dye vat as a retard, acting in a manner similar to Glauber salt in the acid dye bath. It is added as a thin solution. For heavy shades various ammonium salts are also added to the vat to aid exhaustion. Ammonium chloride, acetate and formate are used. The volume of the dye bath is generally about twenty times the weight of the stock to be dyed. The following formula for the correction of the dye bath water and preparation of the dye vat is given as satisfactory for most Helindone dyes. For each 1,000 liters (265 gallons) of dye liquor take

500 grams glue in thin solution,
500 grams ammonium hydroxide,
200 grams hydrosulphite, concentrated, powder, and
500 to 750 grams ammonium formate or other ammonium salt.

The ammonium salt may be omitted if desired. In the preparation of both stock and dye vats, as in all other dyeing, only the purest water should be used.

A sufficient quantity of the stock-vat solution is then added to the dye vat, the wet-out stock is entered and the dyeing proceeds at 50 to 75 deg. Cent. (120 to 165 deg. Fahr.), depending upon the particular dye used. (See Table 1.)

The use of glue in the dye bath as a retard greatly aids penetration and leveling, allowing the use of much less alkali and hydrosulphite. Various other assistants or retards have also been recommended, among them anthraquinone 30 per cent paste, glucose, pyridine, sulphite liquor and its dried residue, as well as sodium bicarbonate, sodium bisulphite, lactic, benzoic, malic, phthalic, phosphoric, cresylic or carbolic acid to reduce the alkalinity of the dye vat without precipitation of the dye. The addition of ammonium salts aids exhaustion, allowing lower dyeing temperatures to be used.

The stock should be well wet-out before entering the dye bath. The addition of a little sulphonated oil to the warm wetting-out bath materially aids leveling. The raw stock is worked well while in the dye bath and the dyeing is usually complete for light shades in about twenty to forty-five minutes. The stock is then removed from the bath, squeezed or extracted and allowed to oxidize in the air for twenty minutes to two hours, after which the stock is rinsed, etc. For light shades this single dip is usually sufficient, and the dye bath is generally about 65 per cent exhausted, but for darker shades the stock is returned to the dye bath for a second dip after the oxidation, but before rinsing. This second dip will remove considerably more color from the bath, usually giving a 75 to 80 per cent exhaustion, figured on the original weight of dye used. After squeezing the stock is again allowed to oxidize in the air for twenty minutes to two hours, when a third dip may be given if desired.

In dyeing even medium shades it is always best to give the stock two dips, as it insures more level shades, better exhaustion, better penetration and a nearer match to shade. In practice the best results appear to be obtained by dyeing small lots in machines equipped with a basket, liquor circulating apparatus and squeeze rolls which return the excess of dye liquor to the bath. Such a machine is shown in Figs. 2 and 3.

In using Helindone vat dyes, the dye vat should be sufficiently alkaline at the start to give a ruby red reaction with phenolphthalein solution. The exceptions to this rule are Helindone Fast Scarlet C, which is dyed weakly alkaline, and Helindone Gray BB, which is dyed almost neutral.

TABLE I—PREPARATION OF STOCK AND DYE VATS

(For each kilogram dyestuff, 2.2 pounds)

	Liters Hot Water	Grams Turkey Red Oil	Grams 77° Tw. NaOH Soln.	Grams Hydrosulphite Powder Concd.	Temp. of Stock Vat °F.	Appearance of Reduced Vat	Temp. of Dye Vat °F.
Helindone Yellow GG Paste	3	100	300	125	150	Yellowish, turns brown slowly	130–170
Helindone Orange R Paste	3	100	240	100	150	Pale yellow, slowly turning orange	150–170
Helindone Brown G Paste	3	100	240	100	150	Pale yellow, turns slowly brown	150–170
Helindone Brown CR Paste	3	100	320	125	150	Pale brown, slowly turning redder	150–170
Helindone Fast Scarlet C Paste	5	100	320	180	120	Bluish-violet, turns slowly red, then brick-red	120–170
Helindone Pink BN Paste	3	100	270	100	150	Bluish-yellow, turns rapidly bluish-pink	150–170
Helindone Red B Paste	6	200	480	200	150	Olive-yellow, turns quickly brownish-red	150–170
Helindone Violet R Paste	6	200	400	200	150	Olive-green, then violet	150–170
Helindone Violet BB Paste	6	200	480	200	150	Olive-green, then bluish-violet	150–170
Helindone Violet B Paste	6	200	440	200	150	Olive-green, turning violet	150–170
Helindone Gray BR Paste	6	200	350	200	150	Impure yellow, turns bluish-green	150
Helindone Gray BB Paste	6	200	300	300	120	Impure yellowish-green, turns quickly bluish-green	120
Helindone Blue BB Paste	6	200	440	200	150	Golden-yellow, slowly turning green, then blue	150–170
Helindone Blue 3G Powder	3	100	220	100	120	Yellowish-brown, quickly turning green, then blue	150

Dye	Powder for Each	Paste for Each	Hot Water	Monopole Soap	NaOH 75° Tw. Soln.	Hydrosulphite Powder	Temp. °F.	Appearance	Dye at °F.
Hydron Pink FF	3 lb. 4 oz.	20 lb.	10 gal.	2 lb.	6 lb. 6 oz.	3 lb.	150	Yellow to yellowish-red	140
Hydron Pink FB	3 lb. 4 oz.	20 lb.	10 gal.	2 lb.	6 lb. 6 oz.	3 lb.	150	Yellow to yellowish-red	140
Hyd. Scarlet BB	3 lb. 4 oz.	20 lb.	10 gal.	2 lb.	6 lb. 6 oz.	3 lb.	150	Orange to brownish-orange	140
Hyd. Scarlet 3B	3 lb. 4 oz.	20 lb.	10 gal.	2 lb.	6 lb. 6 oz.	3 lb.	150	Orange to brownish-orange	140
Hyd. Orange R	2 lb.	20 lb.	6 gal.	2 lb.	2 lb. 12 oz.	2 lb.	150	Brownish-yellow	140

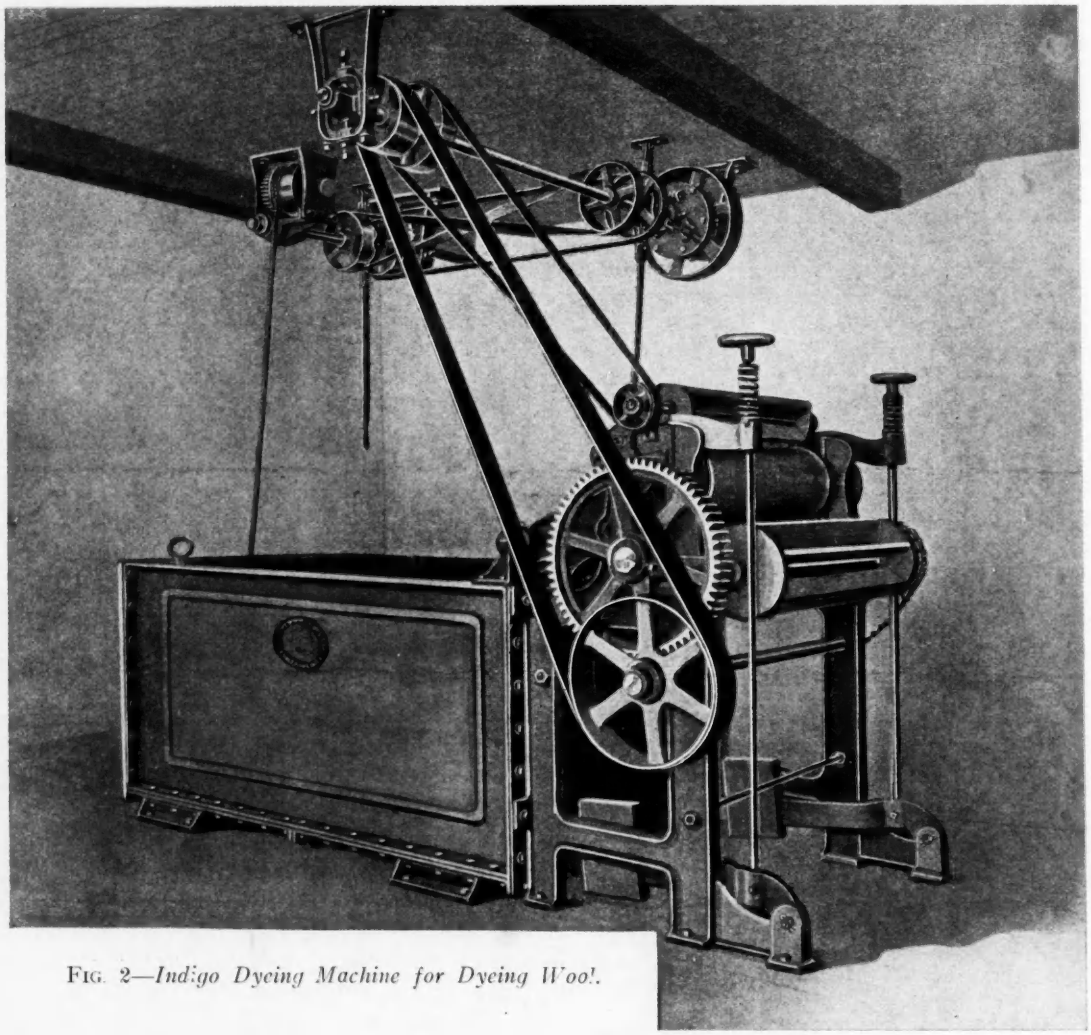

FIG. 2—*Indigo Dyeing Machine for Dyeing Wool.*

As the stock vats are not always stable, they should be added to the dye vat immediately upon reduction. After squeezing or rinsing with cold water, the dyed stock may be soured with 5 per cent acetic or 2 per cent formic acid for fifteen minutes at 70 to 100 deg. Cent. (160 to 212 deg. Fahr.), to complete the oxidation of the dyestuff. In using the dye bath continuously, the vat must be replenished with alkali and hydrosulphite before the addition of dye to replace that removed by the previous dyeing. Very little glue need be added. Wool dyed in this manner has a softer feel and much better handle than stock boiled for several hours, as in the mordant dyeing process, and in addition to this its tensile strength is about 20 per cent higher than the mordant dyed stock.

For dyeing slubbing with Helindone dyes the following instructions are given by the manufacturer: Dye in loose hanks in open vessels under the surface of the liquor. Most colors, with the exception of Helindone Yellow CG, may also be dyed in machines with a reciprocal flow of liquor. It is imperative that the stock be well squeezed or rinsed with cold water immediately after the dyeing operation to insure even oxidation.

For slubbing the dye vat is prepared by adding to each 1,000 liters (265 gallons), of dye bath, 500 grams of glue in solution, 500 grams of soda ash, 500 grams Turkey Red Oil and 150 grams hydrosulphite powder concentrated. Then add the required amount of dyestuff from the stock vat, which is prepared as shown in Table I.

In formulas containing a combination of dyes, the dyes may be reduced either before or after mixing, but best results are usually obtained by reducing the various dyes separately. Another method of preparing the dye vat, recommended for Hydron wool dyes, is to add to each 1,000 liters (265 gallons) of dye bath at 50 deg. Cent. (120 deg. Fahr.), 600 grams of glue in solution, 600 grams of 25 per cent ammonium hydroxide and 225 grams of hydrosulphite powder concentrated.

The following formulas will give more specific information regarding several vat dyes and indigos not mentioned above: Helindone Khaki C Vat is dyed in an open vat as follows: Use 100 parts of liquor to one of wool, and to each 100 gallons of dye liquor at 50 deg. Cent. (120 deg. Fahr.), add 5 ounces of glue in solution, 5 ounces of 25 per cent ammonium hydroxide and 3 ounces hydrosulphite powder concentrated. This should give a weak alkaline reaction with phenolphthalein; if not, add more ammonia, then add the prepared dye in "vat" form. For use in dye machines equipped with rolls, use only 25 parts of liquor to one of wool and add eight ounces of glue, eight ounces of ammonia and eight ounces of hydrosulphite powder concentrated, to each 100 gallons of dye liquor at 50 deg. Cent.

Helindone Black B Vat exhausts almost completely on the second dip in a neutral or mildly alkaline bath at 50 to 55 deg. Cent. (120 to 130 deg. Fahr.). In an open kettle 60 to 80 pounds of wool are dyed in 720 gallons of water containing three pints of concentrated glue solution, 2½ pints of 26 deg. ammonium hydroxide and 10 to 14 ounces of hydrosulphite powder.

Stock Vat for Indigo MLB/4B

10	Indigo MLB/4B paste
4.8	Sodium Hydroxide, 40 deg. Be. solution
2	Monopole soap
60	Water
2	Hydrosulphite powder concentrated, at 65 deg. Cent. (150 deg. Fahr.).

Stock Vat for Helindone Blue 3G Powder

10	Helindone Blue 3G Powder
2.2	Sodium hydroxide, 40 deg. Be. solution
1	Monopole soap
30	water
1	Hydrosulphite powder concentrated, at 50 deg. Cent. (120 deg. Fahr.).

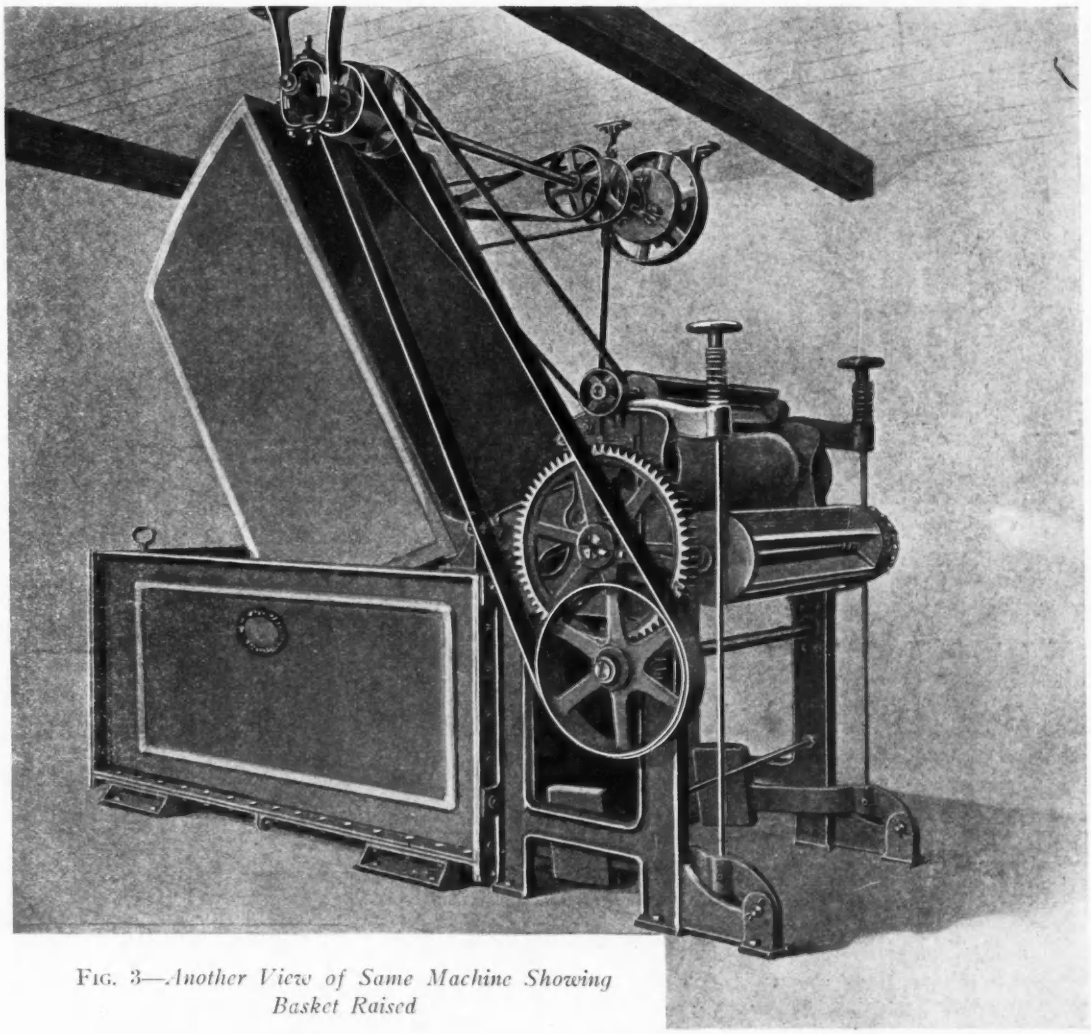

FIG. 3—*Another View of Same Machine Showing Basket Raised*

Dye Vat for Helindone Blue 3G Powder

1.5 Glue in solution
1.5 Soda ash
1.5 Monopole soap
1.5 Hydrosulphite
3000 Water at 60 deg. Cent. (140 deg. Fahr.).

Stock Vat for Helindone Brown CM Paste

10 Helindone Brown CM Paste
1.5 Sodium hydroxide, 40 deg. Be. solution
30 Water
1.5 Hydrosulphite.

Stock Vat for Indigo MLB 20 Per Cent Paste

10 Indigo MLB 20 per cent Paste
3 Sodium Hydroxide, 40 deg. Be. solution
60 Water
3 Hydrosulphite.

Stock Vat for Indigo MLB/2B Paste

10 Indigo MLB/2B Paste
4.4 Sodium hydroxide, 40 deg. Be. solution
2 Monopole soap
60 Water
2 Hydrosulphite at 65 deg. Cent. (150 deg. Fahr.).

Dye Vat for Indigo MLB/2B Paste

3000 Water
3 Glue in solution
1 to 2 Sodium carbonate
2 Monopole soap
½ Hydrosulphite at 60 deg. Cent. (140 deg. Fahr.).

Possibly the latest formula for vat dyeing wool, either in an open vat or in a dyeing machine, is as follows: Use a bath of 30 or 40 to 1. For each 100 pounds of wool take 8 ounces of freshly dissolved glue, 2 to 3 pounds 25 per cent ammonia, 1 pound 8 ounces to 3 pounds hydrosulphite concentrated, with the desired amount of Helindone vat dye in "vat" form, and reduce for 1 hour or longer if necessary. The complete reduction is very important and must be given very careful attention or the dye will not penetrate and therefore will not be fast.

Prepared in this manner, the dye bath should have a clear yellow appearance, and a decided alkaline reaction to phenolphthalein. The stock is entered at 120 deg. Fahr. and worked for about 30 minutes, keeping it well under the surface of the dyebath. Then slowly neutralize the dye bath by adding 2 to 3 pounds of ammonium acetate, or 1 pound 8 ounces to 2 pounds 8 ounces of ammonium sulphate in dilute solution. This should leave the bath nearly neutral and only faintly alkaline to phenolphthalein. Work the stock for fifteen minutes more and then exhaust the bath slowly by adding to to 5 pounds acetic acid, or 3 to 6 pounds of ground bisulphite, in dilute solution, over a period of 15 minutes, while working the stock well. The dye bath should now show a slight acidity to phenolphthalein.

The exhausted bath may now run off, and fresh, cooler water added while working the stock slowly to aid the oxidation and cool the stock. When cooled, the stock may be rinsed and extracted, after which the oxidation may be completed by exposure to the air. Samples for matching can be quickly oxidized to shade by steaming for a short time.

In case an addition of dye to the dye bath is required after adding the ammonia salt, the dilute solution of dyestuff may be added to the bath slowly without any other addition. However, if the dye must be added after the addition of the acid or bisulphite, the bath must first be made alkaline with ammonia before adding additional dyestuff. After the dye is added, the bath is again acidified to exhaust it, as before.

In this manner various combinations of Indigo MLB/R vat, Helindone Brown C3R vat and Helindone Yellow CG vat have been applied to obtain various shades of tan or brown. Indigo MLB/R vat and Helindone Red 2B vat combined to give a violet. Indigo MLB vat I combined with Helindone Yellow CG vat for green shades, with or without the addition of Helindone Brown C3R. Indigo MLB/R vat, Helindone Brown C3R vat, Helindone Red CR vat and Helindone Yellow CG vat to give a reddish brown. Indigo MLB/R vat and Helindone Brown C3R vat to give a gray. Indigo MLB vat I and Indigo MLB/R for blue; or the Indigo MLB/R vat may be combined with Helindone Brown C3R vat; or the Helindone Brown C3R vat and Helindone Yellow CG vat may be combined with either of the above indigos for a greenish blue; also Indigo MLB/R vat may be shaded with Helindone Red 2B vat for a violet shade of blue, etc. In fact, almost any combination of Helindone Yellow CG vat, Helindone Red 2B vat and CR vat, Helindone Brown CM vat and C3R vat, Indigo MLB/R vat and MLB vat 1 may be made, with which almost any shade may be obtained.

The application of vat dyes to colored all-wool shoddy has an added advantage in that previous stripping of the colored shoddy may be entirely avoided in most cases, the stripping of the acid dye taking place in the vat dye bath simultaneously with the dyeing. In this way the stripping operation is avoided and a very material saving is effected. In case the shoddy has been carbonized care must be taken to see that it is completely neutralized before it enters the dye bath.

In applying the Hydron Wool dyes to wool shoddy, the manufacturers recommend that either the regular open vat may be used for loose wool, or the circulating dyeing machine. For each 100 pounds of shoddy the dye bath should contain one-half pound freshly dissolved glue, 2½ to 3½ pounds of 25 per cent ammonia

and 1¾ to 3 pounds of hydrosulphite conc. powder (anhydrous sodium hydrosulphite, American trade name Lykopon), together with the required amount of vat dye.

The dye may first be ground up with glycerol, pyridine or one of the solvent preparations previously mentioned, to facilitate the reduction of the dyestuff. This paste is then gradually diluted with water containing ammonia and dissolved hydrosulphite at about 160 deg. Fahr., until the solution contains at least 5 gallons of water for each pound of dye present. Each dye should be dissolved and reduced separately in combinations. It is best to allow at least 15 minutes to insure complete reduction of the dye, as much depends upon this point. The reduced dye solution is added to the dye bath containing the balance of the chemicals.

The dye bath should present a clear yellowish coloration and react feebly alkaline to phenolphthalein, but the red color of the test solution should soon disappear. The shoddy is entered at 120 deg. Fahr. and turned for about a half hour or longer, squeezed or extracted and allowed to drain and oxidize in the air. Throughout the dyeing the dye bath should remain perfectly clear and always slightly alkaline to phenolphthalein.

This operation only partially exhausts the dyebath and with care it may be used continuously by adding three-fourths to four-fifths the quantity of dye used in the initial charge. However, in dyeing shades to match, this is rather difficult to control as the color only develops in the fiber upon oxidation. If it is desired to exhaust the dye bath when dyeing light or medium shades, 3 to 5 per cent of ammonium acetate or 2 to 4 per cent of ammonium sulphate, dissolved and well diluted, may be added to the dye bath after the half hour's working as given above, and the stock turned for another 15 minutes. Three to five per cent of acetic acid is then added in dilute solution and the stock turned for a short time. The dye liquor is then allowed to run off, simultaneously adding fresh water until the stock is well rinsed. The stock may then be hydroextracted or squeezed and allowed to oxidize in the air. The above method is particularly applicable to the dyeing of light or medium shades in circulating machines.

The application of vat dyes to wool permits the production of dyeings of unparalleled fastness without detrimental effect in strength or in the spinning property of the wool.

Dye Application in China

Part II

Sulphur Black on Cotton Cloth—Introduction of Sulphur Black to China—Method of Dyeing—Progress in Sulphur Black Dyeing—Other Synthetic Colors on Cotton Cloth—Vegetable Colors—The Dyeing of Cotton Yarn—Direct Colors—Basic Colors for Cotton

By WOO DONG CHI

[*A general description of native dyehouses and methods for dyeing cotton yarn and cloth, silk yarns and cloth, paper in sheets, and wool carpet yarn, with vegetable extracts and synthetic coal tar colors.*]

Sulphur Black on Cotton Cloth

LET us consider the dyeing of Sulphur Black on cotton piece goods, one of the commonest forms of dyeing met with throughout china. We have noted previously that much Sulphur Black is applied to cotton piece goods before dyeing with indigo. The saving of indigo by partially covering the fiber with black, and the mordant action of sulphur colors on indigo, were early recognized by the Chinese. Coming to Sulphur Black as a self-shade we find that some is applied in small percentages for gray, but mostly in full strengths for deep blacks. Materials dyed with this color are used principally for outer garments for men and women.

Introduction of Sulphur Black to China

Sulphur Black was first introduced into China by the German firm of Leopold Cassella about 1910. Nothing like it had been known previously, and the natives were very conservative about giving it a trial. By dint of much "missionary work" and with many demonstrators traveling all through the country, a foothold was secured. During the war, with the establishment of a dye-making industry in Japan, the Japanese pushed the sale of such color with much energy, especially in Manchuria, Shantung and other northern provinces, so that its use is now well known and firmly established.

It is of interest to note in passing that the Germans, when introducing Sulphur Black, packed in the center of each keg of color a tin case of fused sodium sulphide, sulphide of course being an unknown "medicine" to the native dyer.

All the sulphide used in the country now comes from Japan and can usually be purchased by itself in any large market town in a dyeing district.

Method of Dyeing

The apparatus for dyeing Sulphur Black is a kettle set over a fireplace as described previously. One capable of holding a hundred gallons or more is the usual size. The pieces are not sewed together. Sometimes a preliminary boil-off is given with alkali to remove the size, but this is often omitted, it being found that the sulphide used in dyeing is alkaline enough to remove size and other impurities so that even penetration of dyestuff results.

It seems only necessary to describe the dyeing operation in a general way and to note where it differs from that carried out in Western countries.

At the present time German-made Sulphur Blacks predominate in the market. The usual strength sold is that approximating Immedial Black NNG. There is some variation in shade demanded, but the bulk of the requirements seem to be for the rather bluish NNG, the balance being for the redder brand of the same tinctorial value.

The Chinese understand the economy of the standing bath, and never throw away a vat as long as even passable results may be obtained. In this they are aided by the fact that no salt is even added to the dye bath. It may be taken as a general rule covering the dyeing of all textile materials in China, that neither salt nor Glauber salt are added as dyeing assistants. Glauber salt cannot be had in the interior. Common salt has for a long time been a Government monopoly, and the dyers consider its use a sinful expense.

Salt in China is produced partly from the natural evaporation of sea water and partly from wells (the salt wells of Szechuan Province are especially famous). The Chinese Government tax the salt as it is produced and usually several times more during its distribution throughout the country. A fairly pure brand of commercial salt costs in Tientsin (near salt fields) about the equivalent of 2½ cents Unites States money per pound.

A starting bath of Sulphur Black will contain 20 per cent dye based on the weight of the goods, 10 per cent fused sodium sulphide and water to fill the vat two-thirds full—nothing more.

The clean vat, filled two-thirds with water, is brought to a boil and the lumps of sulphide added. After boiling for five minutes the color is sprinkled. A five-minute boil with occasional stirring is considered sufficient to insure proper solution of the color. The drafts of the fireplace are closed, a few pailfuls of cold water are added, and the material entered.

The method of adding the material is the same as that already described in the dyeing of Vegetable Black.

The goods are boiled hard for ten or fifteen minutes with occasional stirring with a pole, then removed. Sometimes the material is taken from the vat by pulling by hand through a wooden "pot eye" which is small enough to squeeze out most of the excess liquor. Some of the more mechanically inclined dyers have developed a set of small wooden squeeze rolls, turned by hand with a crank, and mounted on a stand which may be moved from vat to vat as required.

With whichever method used for squeezing, the steaming material is thrown directly into a kong of cold water, usually water in which previous batches have been rinsed. The goods are opened out by hand and run back and forth a few times, then coiled on the cross piece of a post and twisted with a stick. Care is taken that all liquor squeezed out falls back into the kong. The rinse water from this kong is used in replenishing the volume of liquor in the dye vat. From time to time the sediment from the rinse vat is taken out and added to the dye vat.

Another rinse is then given in a second kong. After a second twisting the cloth is opened out and flapped back and forth a few times by two workman, one at each end, to straighten it, and hung on racks to dry.

The black produced by such a process is of a satisfactory appearance and when finished with starch and calendered between stones compares very favorably in appearance with anything that is imported from abroad.

The chief points of interest are: (1) The lack of proper preparation of the cloth before dyeing (boil-off usually omitted); (2) the fact that no salt is used in the bath; (3) the short time of dyeing, and (4) the scanty washing and rinsing.

There has been some complaint among the wearers of black cotton garments that such material does not last very long. This complaint can be traced directly to the factors mentioned above, particularly the last one, yet sales of Sulphur Black are on the increase with each passing year, while dyeing methods tend to show little, if any, improvement on the part of the great mass of small interior dyehouses, which are the backbone of the consumption of this and all other colors.

Progress in Sulphur Black Dyeing

The foregoing gives an idea of the general native method of applying Sulphur Black to cotton piece goods. In the treaty ports of Tientsin, Hankow and Shanghai there are a few firms (possibly half a dozen altogether) who use jigs. Two of these installations are under the supervision of foreign dyers. In Canton there are about a dozen shops which have each one or two jigs. They are turned by hand. Heat is supplied by direct fire. The bodies of the jigs are made of cast iron molded locally. These Cantonese shops make the same mistake of not washing the material sufficiently to remove all the sulphide, with the result that the cloth soon becomes tender. When the writer called this to the attention of one manager he replied with a smile that all his production was for soldiers' uniforms, and so it didn't matter.

Other Synthetic Colors on Cotton Cloth

Other colors commonly dyed on cotton cloth are Congo Red, Direct Blue and Direct Yellow. Congo is applied

(*Continued on page* 835)

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NOVEMBER MEETING OF THE NEW YORK SECTION

The regular monthly meeting of the New York Section of the American Association of Textile Chemists and Colorists convened in Stewart's Restaurant, New York City, on Friday evening, November 28, at eight o'clock, E. F. L. Lotte presiding as Chairman.

The minutes of the last meeting were read by the Secretary and approved as read. After the routine business of the section had been transacted Mr. Lotte introduced the first speaker for the evening.

Chairman Lotte—We will now go right on with the papers to be presented this evening. The first paper to be read is by Philip S. Clarkson, of H. A. Metz & Co. Someone mentioned to-night just how long Mr. Clarkson has been a textile chemist. I am going to let him tell you that himself if he wishes to, but we are glad at any rate to have him here. He needs no introduction. Mr. Clarkson. (The members arose and applauded.)

P. S. Clarkson—This reception is very gratifying. As Mr. Lotte has said, I have been in the business a long while. I started in '87, but at the present time I am very much interested, as some of our members know, in competitive and non-competitive products. (Laughter) I assumed there would be some young men present to-night who were acquainted with the industry of the present day, so I thought that I would go back to the beginning of my connection with the industry and give a sort of sketch of what has happened during my incumbency, you might say.

. . . Mr. Clarkson then presented his paper which is published below:

THE DYESTUFF LABORATORY AND THE MILL—PAST EXPERIENCE

By PHILIP S. CLARKSON
H. A. Metz & Co.

We are all familiar with the present relationship between the mill, or consumer rather, and the laboratory of the dyestuff seller or manufacturer, and I think this evening it will be more interesting to review in a cursory manner the past experience of thirty-five years in the growth of synthetic dyestuff production and application.

At the time the writer first entered the business, about the end of 1887, it was twenty-one years after the discovery of Mauveine by Perkin, but large fields of coal tar dyestuff possibilities had not been discovered and the workings in others had barely commenced.

My first position was as chemist to what was then by far the largest custom dyehouse in the United States. Its work comprised woolen and worsted raw stock, yarn and piece goods, certain lines of cotton piece goods, cotton yarns and some raw cotton. Both fast colors and what were known as "ordinary," were dyed. The requirements for fast colors were vastly different from what they are at the present time.

Turning to the dyestuffs used, what were these? Logwood, Cutch, and Fustic in largest quantities; the logwood and cutch being principally in the form of chips as we had our own extractors. These were used for wool dyeing and some extractors were brought for cotton. Also Cochineal, Flavine and some Sanders, while Indigo Extract (Carmine) was the mainstay for blue. The anilines

used were Scarlet, Orange, Fast Red, Alkali Blue, Bismarck Brown, Chrysoidine, Safranine, Magenta, Eosines, Methyl Violet, Malachite and Brilliant Greens; Alizarine Red and Alizarine Brown Paste for fast colors. Shortly before this period the first of the one-dip cotton colors had made its appearance, and we were using about five or six at this time. Neither the one-dip nor the diazotized and developed cotton blacks were on the market. This is a very meager list compared with what the present-day dyer has in his dyehouse.

The dyers of that day, as was to be expected, were very jealous of their knowledge, regarding their trade as their capital. They were very loath to reveal very much, except for a proper consideration on their own terms, and learners were charged a good round sum for the privilege of acquiring the art. I know of two cases where $1,000 was paid to the dyers to take an apprentice. The pinnacle of the art was reached by the Indigo dyer, as he was master of the most mysterious process in use, and anyone capable of managing Indigo Vat properly was a past master. The services of the seller's laboratory, if there was one, had little interest for them.

During the next five years, while the writer may be termed to have been on the mill side, a very large development in the production of acid dyestuffs took place. They were most welcome to the fancy color dyers of those days, who had been wrestling with basic dyes with their resulting uneven shades and very fugitive colors. The Rhodamines, Violamines and Patent Blues were received with open arms, or rather kettles, and the troubles of the morning hour at the perch was considerably lessened. Incidentally, we dyed the first Acid Black yarn for the custom trade about the year 1890.

The dyestuffs for the fast color line were also improved, but it was not until about the end of this period that a material advantage was shown. Navy blues were generally Prussian Blue topped, Logwood with alum mordant, or Logwood on chrome with Victoria Violet B to brighten it, and some very few were made with the first Alizarine Blue B or DN pastes which were insoluble and difficult to handle. About 1890 or 1891 appeared the Alizarine Blue N brand of the Badische and Anthracene blues of the Bayer. These were exploited extensively by the makers and sellers, and about this time came the first campaign for "fast-to-light colors," which helped largely in their sale, the older brands having many weak points, especially that of being fugitive to light.

I wonder how many of the members present remember the display of the Badische at the Columbian Exposition in 1893, where Badische exhibited samples of Alizarine Black exposed for a certain length of time in Florida and in the Mississippi Valley.

In the cotton department the history is practically parallel. The natural dyestuffs were by far the largest in amount, Cutch, Fustic and Logwood being the principal mainstays. These were used chiefly in the form of extract, either 42 deg. or 51 deg. Be. At that time the aim of the extract makers was to furnish an extract that would produce results as near as possible to those of the natural wood. An oxidized logwood extract or hematine was just coming into notice. The only dyestuff largely in use then that has continued in the same or larger quantity to-day is Indigo, but the source of this has very materially changed. Natural Indigo was the only one commercially known then, while by far the greatest amount consumed to-day is synthetic.

The black from aniline salt had not been fully developed and the foreigners were far ahead on that. The one-dip or diazotized and developed blacks for cotton that are now used had not yet appeared, only about a dozen or so one-dip cotton colors being in ordinary use.

From your own present experience you can see how the field was occupied since that time, and from the number of cotton dyestuffs in the market, how well the sellers and inventors exercised their skill during the period.

About this time, in 1892, the writer changed from the mill, or consumer's side, to the selling or producing side. The laboratories of the selling agents in this country were not extensively developed and were not much more than stations for the determination of relative values, and in some cases matching competitors' samples. Small sample cards for special purposes were made up from time to time, but it was not until about 1893—and the writer can claim credit for its introduction—that the custom of matching shades and not dyestuffs, on different materials for the practical users, was started. I think I may say that at that time I was the only one that had any mill experience in the selling end of the dyestuff business. This was further developed and extended by other sellers so that it soon became an accepted fact that we (I mean the various dyestuff sellers) could furnish a formula for dyeing any shade on any material. This continued with the rapidly increasing number of colors, until 1914, when the war ended our available supply of dyestuffs. It also put an end, as a matter of course, to the enterprise and further development of the dyestuff industry and the advance has not been resumed. What we are now doing here is covering the blank left by the war, but it is to be hoped that we will soon be in another forward swing.

You are all familiar with the number of dyestuffs now available, and more or less so with those for sale and in use in 1914, and I have sketched an outline of what dyestuffs were in use thirty-five years ago and the methods of producing the various shades. The change in both material and methods is remarkable, but it is entirely due to the enterprise and development of the dyestuff industry by the manufacturers and sellers, and in this campaign the sellers' service laboratories, including the

practical demonstrators played, and are still playing, a very large part. Here was an industry in the hands of skilled technical men, although their methods may have been more or less "rule of thumb" and crude. To change this so that the old formulas and materials were discarded and new ones adopted shows a great deal of hard work and attention.

In about 1890 such was the condition as I have outlined it, and since that time we can consider that all the additions have been taught the dyeing and printing trade by the dyestuff laboratories, mill and service both, for the credit belongs to both.

In wool dyeing the natural dyestuff has practically disappeared; only in rare cases are they used. Even natural Indigo has only a small place, although during the war, before the synthetic makers outside of Germany had organized their plants, there was a revival of the natural and the quality was greatly improved; but with the synthetic supply at hand, the natural again fell off, so that it may be stated in a general way that the old products have entirely disappeared. With the various embargoes, etc., lifted, the wool dyer has at his right hand a complete line of dyestuffs of simple application (comparatively) in producing results meeting all the requirements of brilliancy of shade and permanency.

The chrome developed blacks, blues and yellows have replaced Logwood and Fustic, and the synthetic dyestuffs are far ahead of the natural for fastness, durability and beauty, except that the shade of the handsomest Logwood Chrome Black has never quite been reached by the synthetic product.

The cotton dyers are in a similar position and the great numbers of the dyestuffs for cotton applied in various ways have taken the place of the mysterious and secret processes which were so carefully guarded by the old-time cotton dyer.

So it may be considered that the art of dyeing has been retaught and relearned during the past thirty years, and little of this would have been possible unless the trade had been educated by the workers in the laboratories.

The attractive part of the laboratory work has been the educational side. There is nothing attractive in figuring down the price of Orange Scarlet or Acid Black so that you are one-fourth of a cent cheaper than the other fellow, but in working out new effects, new methods of dyeing, etc., something really seems to be accomplished. Much of this work has been done in the past and doubtless will be in the future. The war was a very serious interruption to this work, but the outlook is now very good with the development of various kinds of artificial silk fibers, and especially the introduction of acetate silk. This last appears to have the least affinity of any of the fibers for the coal tar dyestuffs. Also the war prevented the proper development of the various possible uses of the vat dyestuffs. Everyone now appears to have this in mind at the present time, and we are carrying out many experiments for our friends. This method of dyeing appears to be slated for greatly increased use for all kinds of fibers. Owing to the discovery and improvement of the stable hydrosulphite, this has become the simplest method of producing fast shades on cotton, wool, silk and artificial silk. The principal objection now is the cost but that is usually the easiest to remedy. This appears to be our present task, and let us hope that the consumer and the seller and manufacturer meet with the same practical success as with other new processes in the past.

Chairman Lotte—Is there anyone that would like to ask Mr. Clarkson any questions at this time? I am sure he will be glad to answer them. I am sure we all enjoyed hearing from him on the development of the laboratory, which I am sure has been a great help to all users of dyestuffs.

If there is no one that wishes to ask Mr. Clarkson any questions we will go on to the next speaker, Henry F. Herrmann, of the National Aniline & Chemical Company, who has a paper to present and whom, I am sure, we all will be glad to hear from. He needs no introduction, either. Mr. Herrmann. (Applause.)

H. F. Herrmann—Mr. Chairman, Guests and Fellow Members of the Society: Although the topic of the evening was assigned as "The Relation of the Dye Manufacturer's Laboratory to the Mill," I rather anticipated the very clear, historic and all-inclusive remarks of Mr. Clarkson, and therefore will not attempt to develop this particular phase of the subject any further. I will rather try to go beyond the mere laboratory into the real basic reason for the existence of the laboratory. This I consider to be the science of dyeing.

. . . Mr. Herrmann then presented his prepared paper, "The Science of Dyeing," which is published herewith:

THE SCIENCE OF DYEING

By Henry F. Herrmann
National Aniline & Chemical Company

The subject of this discussion may be more broadly defined as the systematized study of the acknowledged truths and laws pertaining to the coloring of textile fibers. In the technical history of the world it has been found almost invariably that the *art* of producing has preceded the science or systematic knowledge of the truths involved in the particular art.

The aboriginal savages hurled rocks in self-defense; later warriors threw spears and shot arrows. In modern times we fire guns. The art dates back to times

immemorable, but the science of gunnery and of ballistics is of recent development. This example is cited to bring out the fact that arts originate through man's necessities and develop through his experience and ingeniousness.

Science appears later—sometimes by many centuries—to explain and systematize the achievements of the art. Although science has always followed art, it is not just to accord it a secondary place. The most successful craftsmen in any art may be technically unschooled, but they achieve results through intuitive scientific thought.

Wherever science has appeared, the art or craft has advanced with leaps and bounds. Examples to prove this are found on all sides. The navigation by courage, intuition and experience of centuries ago cannot be compared with navigation of to-day, where the senses of sight and hearing are almost completely subservient to purely mathematical calculation.

It is not yet so with the art of dyeing. Its science is badly belated, and even to-day it has not yet established itself as completely the master of the craft. There are, however, many and just reasons for this.

The art of dyeing as we know it to-day is new. It has little in common with the craft of our forefathers, when natural colors and pigments were used. The modern art of dyeing began toward the end of the nineteenth century, when aniline dyes first began to be successfully introduced. Furthermore, the *science* of modern dyeing involves the most intricate phases of physics and chemistry—namely, those applying to the ultra body of the most complex organic substances known, such as dyes and fibers.

It is therefore necessary to set aside many of the ancient theories of dyeing and to build our hypothesis on the latest developments of physical and chemical research. It is unfortunate for the science of dyeing that a number of theories must still exist. It proves that the ultimate *fact* of dyeing has not yet been established, or the most skeptical and conservative experimenter would yield his pet theory in the face of overwhelming evidence in favor of an irrefutable explanation of all the facts pertaining to the art of dyeing.

I will not attempt to enter in detail into the various theories of dyeing which find adherents and active sponsors to-day. It is necessary, however, that the fundamentals of these theories be thoroughly understood, since I firmly believe that there is truth in all of them and that much that ails the science of dyeing is due to a lack of compromise. Many experimenters theorize on textile fibers as though they were all more or less alike. An experimental result derived from tests on wool is enlarged to apply to silk and cotton. Vice versa, results obtained with a certain dye are magnified to explain the application of all other dyes. This is wrong. The term "dye" is applied to a multitude of complex organic substances representative of most of the known forms of chemical structure. No one would hypothesize on the drug quinine as a result of experiments on starch—merely because they are plant derivatives. Yet we theorize on Alizarine Sapphire because of experiments with Congo Red! Wool, silk, cotton and the many other industrial fibers differ widely in physical and chemical structure, yet many experimenters jump from one to the other as though their inherent differences were of no significance.

The foundations of all science are fact and system. The day is near when some one will reassemble what is now a patch-quilt of disjointed theories, facts and observations, into a tenable, all-inclusive science of dyeing.

The four existing theories of dyeing are: (1) The mechanical or physical theory; (2) the chemical theory; (3) the colloid-diffusion and absorption theory; (4) the electrical theory.

The mechanical and chemical theories have been for decades the center of energetic discussion and controversy. The colloid and electrical theories have been developed in this century. They are scientific attempts to supplement and correlate the older theories in the light of modern physical-chemical discoveries. Since they are not mutually exclusive as compared with the older theories, they should not be considered parallel to them.

In the *mechanical* theory an analogy was drawn from the absorption of colors by charcoal. Dyes were considered to be similarly absorbed by fibers and in some instances adsorbed. By adsorption is meant the withdrawal from solution of one solid by another solid. Absorption, on the other hand, considers the purely mechanical soaking up of solvent and solute by a solid and a retention of the solute by evaporation of the solvent.

It is found that purified charcoal loses its property of absorption, which latter action is now attributed to the presence of nitrogenous organic compounds produced by the combustion of protein substances. Since a combination of nitrogenous organic substances with dyes suggests a chemical action, the mechanical theorists were forced to look for other proofs.

The dye particles are supposed to wander from solution by endosmosis into the pores of fibers and be there fixed as insoluble lakes with mordants in a hot bath. On cooling, the fiber pores shrink and the dye is tightly held. This may be true where dyes are ap-

plied on mordanted fibers, but the theory is untenable in the face of many contrary facts. Assuming that the fiber pores become larger as the dye bath is heated but that the dye particles become smaller, one would rightly deduce that dyeing would be hampered by heat. Furthermore, the addition of acid or salt to the dye bath is supposed to enlarge the dye particles but to shrink the fiber pores. Under these circumstances purely mechanical dyeing would be prevented.

Von Georgevics, who is the leader of the mechanical theorists, claims that the dye particles are in a state of adhesion on and in the fiber, and are not in a state of either solution or chemical combination with it.

This adhesion is analogous to capillary attraction—to the adhesion of solute to solvent and to that exerted by glass on a liquid which wets it.

Von Georgevics admits the dissociation of basic dyes dissolved in water—admits that if the base is attracted to a substance in contact with it a colored body results. This feature of attraction, also named affinity, again weakens the mechanical theory, since affinity between substances can be explained only by chemical or electrical hypotheses. When bodies which are attracted to one another and combine lose their identity, a chemical combination is understood to have taken place. If they are not changed an electrical union, due to opposite electrical charges, must have taken place.

In some instances dyeing may be assumed to be purely mechanical where the dye in the form of "coarse gel" is pasted on the fiber and is forced to adhere either by a removal of the solvent or by the addition of a coagulent or simple adhesive. Certain forms of padding and the elementary phases of printing are thus explained.

The Chemical Theory

The chemical theory, on the other hand, assumes a chemical combination between fiber and dye—in short, a salt formation. Fibers, such as wool and silk, which by hydrolysis give amino acids contain salt-forming groups and produce actual salts with dyestuffs containing acid and basic groups. This salt formation is analogous to the salts resulting when simple acids and bases (alkalies) are combined.

Since the formation of a salt results in a chemical change of the two components entering into the reaction, there is much doubt attached to this theory. Wool dyed with an acid red must then be considered as a new substance; namely, a wool-dye-salt. This is not true, since the dye can be removed and its identity, so far as we know, remains unchanged. The wool can be stripped of its dye and to all appearances and in its chemical behavior is the same as virgin wool. There are many reversible reactions in the chemical realm, but the wool-salt reaction does not parallel them sufficiently to serve as a comprehensive explanation of dyeing in general.

When chemicals combine they obey certain definite laws. An invariable one is that of multiple proportion. All substances combine with one another in proportion to their molecular weights. Furthermore, heat is either given off or absorbed. I have not been able to find a citation to the effect that any experimenter has succeeded definitely to establish either of these points. Knecht prepared lanuginic acid by dissolving wool in barium hydrate solution, precipitating the barium with carbon dioxide. The lanuginic acid was then precipitated from solution with lead acetate. The lead was removed with hydrogen sulphide and filtered off. The solution was then evaporated. The lanuginic acid so obtained gives bright precipitates with solutions of either acid or basic dyes.

Wool and silk absorb and hold dyes tenaciously and resist boiling acids and alkalies. They absorb dye bases from neutral baths, leaving the whole of the acid from the dye in the bath in the form of the ammonium salt. For these reasons Knecht, who is the main exponent of the chemical theory, deduces that definite chemical compounds are formed between color bases or acids with some break-down product of wool or silk of the nature of lanuginic or sericinic acid.

As a corollary to the chemical theory is the *selective solution* theory of Witt (1890), which is very interesting, though not adequate to cover all cases of dyeing. Witt considers dyeing as a selective solid solution phenomenon similar to the fusion of metals to form an alloy. He considers the fiber and dye as mutual solvents for one another.

Dyeing depends on both dye and fiber, and the absence of dyeing action frequently cannot be explained chemically but can by choice of solvent. When dyeing takes place, the fiber exhibits a better solvent action on the dye than does the water of the bath, and absorbs or dissolves the dye in the same manner that ether extracts iodine out of a water solution. Ether will also absorb resorcine out of a water solution, but benzol will not. Yet benzol dissolves resorcine ordinarily.

Keratin and fibroin, the basic substances of wool and silk, are good solvents for dyes; cellulose is a poor solvent.

Witt further proves his theory by the fact that the color of a dye when ordinarily applied to a fiber is that of its water solution and not of its physical substance. Fluorescein is a brownish powder, but it yields fluorescent shades when dyed characteristic of

its water solution. A mechanical dilution of the dye powder with chalk does not yield a fluorescent yellow. Similarly Patent Blue appears as a purple powder and Fuchsine as a green powder, but both yield dyeings matching the shade of their solution in water.

The Colloidal Theory

Before delving into this, the most complex of the dyeing theories, I consider it well to review rapidly the elements of colloidal chemistry. The word "colloid" is derived from the Greek meaning *glue-like* or pertaining to glue. The term is applied quite generally now to substances resembling soaked carpenters' glue in physical properties. When a crystalloid (which is here considered as the antithesis of a colloid) dissolves in water it does so in the same manner as gases diffuse in one another. The crystalloid breaks down from its surface inward until the whole is dissolved. A colloid swells up as a whole, assuming larger and larger dimensions until it has absorbed within itself the water with which it is in contact. Then at a certain optimum temperature it becomes fluid, yielding a colloidal solution.

A typical colloid is silicic acid which is formed as a voluminous precipitate when hydrochloric acid is added to a concentrated solution of sodium silicate. This gel can be washed free from sodium chloride, the other component of the reaction. By evaporation with heat the water can be driven off, but it requires strong ignition to remove the last traces of moisture. The final substances is silicic acid. It melts with the oxy hydrogen flame and on cooling congeals to transparent quartz glass. When cooled very slowly it crystallizes into small crystals.

It follows that we have for the one substance, without any chemical change, three forms: colloidal, glassy and crystalline state.

The salt can be removed from silicic acid precipitated with hydrochloric acid out of a sodium silicate solution by dialysis. The mixture is placed in a container with a parchment base and the whole dipped in distilled water. The silicic acid will remain in the container, but the salt will pass through the membrane into the water.

This demonstrates one of the fundamental characteristics of colloids, that they will not dialyze, that is, pass through the usual membrane by osmosis.

A colloidal solution is commonly termed a sol; when in water a hydrosol; in alcohol an alcosol. The precipitated colloid is called a gel.

Colloids do not obey the usual laws of solution or equilibrium such as pertain to metallic salts. The latter yield stable solutions, providing the concentration of solubility has not been exceeded. Colloidal solutions are apt to precipitate flocculent gels on standing; boiling frequently accelerates this decomposition.

Colloidal solutions are sensitive toward changes in the content of electrolyte (dissociable crystalloid), but are generally considered as requiring the presence of some of this substance for stability.

Colloids move in the field of an electric current. A current of 110 volts potential passed through a colloidal solution shows practically no passage of current but the colloid particles aggregate at one pole. Metallic colloids usually migrate to the positive pole, or anode. Therefore, they are considered as electro negatively charged since opposite polarities attract. Iron and aluminum hydroxides migrate to the negative pole and are therefore termed electro positive.

This electrical migration is influenced by the addition of small amounts of electrolyte found even in pure solutions. A small increase of hydrogen ion in water electrifies the sol positively so that it migrates to the negative pole; vice versa a minute increase in the hydroxyl ions electrifies it negatively and the particles migrate to the positive pole.

These facts pertaining to colloids must be understood to appreciate the significance of the behavior of certain dyes which are colloids toward the textile fibers which are all colloids. Furthermore, the colloidal theory of dyeing premises electric valences on the part of dye and fiber colloids, and uses these to explain coagulation of the one on and in the other which is the ultimate end in dyeing.

Kraft's theory assumes that a colloid solution or system contains the solute in molecular form: the molecules are large in mass and volume and tend to form systems rotating round one another. When the gel coagulates these spheroids become rigid.

In dyeing Kraft supposes that absorption takes place but that the solid solute combination is a loose one, possibly an incomplete chemical compound at times. It does not, however, obey the law of multiple proportion.

Benzopurpurine, Chrysophenine and Congo are generally considered as typical colloids. Yet Knecht and other experimenters deny this because these dyes are supposed to yield solutions which are electrically conductive and because they exert osmotic pressure. The matter of osmosis of these dyes is surrounded with considerable doubt since the osmotic pressure, as previously explained, is very dependent on the presence of small amounts of electrolyte.

Experimenters who used absolutely pure Congo could not develop any osmotic pressure and classed this dye as well as other direct colors as colloids because of this fact, as well as because of their low diffusibility and their optical visibility in the ultra microscope.

Zacharias in 1900 advanced the theory that dyeing consists of colloid inter diffusion plus adhesion due to precipitation. He considered the cohesion between dye and

fiber as of an electrical nature comparable to an ion combination. Essentially dyeing consists of coagulation of colloids in or on another colloid due to opposite electrical charges in such form as to be insoluble.

Dreaper also supported this theory since dyeing is always carried out wet so that the fiber may be sufficiently hydrated to act as a hydrosol of the gelatine type.

He described dyeing as occurring in six states or phases:

1. A solution state of the dye within certain limits of aggregation.
2. A fiber state corresponding to this aggregation and of permeable nature.
3. The effective localization of the dye within the fiber area due to surface concentration.
4. The localization of salts, acids, etc., within the fiber area.
5. Indirect entrance of dye aggregates by molecular migration with subsequent reformation of aggregates within the fiber area.
6. A desolution due to secondary attraction between fiber substance and dye.

Dyeing by the colloidal theory depends on the diffusion of two colloids of opposite potential and their coagulation because of electrical difference. Conversely, colloids of similar potential do not precipitate one another. Such colloids are termed "protective." They may be combined in order to accentuate their particular electrical charge, and therefore to render less potent the charge of an electrically opposite colloid or other substance. A striking instance of this is the rendering of Benzopurpurine relatively fast to mineral acids by the addition of gelatine to its solution. When dyed on wool, a similar behavior is noted.

Electrical Theory

Four factors are considered in this theory:

1. Molecular movement, by which dye molecules or particles transport themselves onto the fibers or into its pores. In true solution this process is called diffusion, and must be taken into account in all theories of dyeing. In colloidal solutions the same thing occurs, but to less extent.

2. Electrical charge on fiber and dye. The potential of this charge has been measured under several conditions as regards nature and concentration of added electrolytes.

3. Size of pores in fibers. These pores occur in natural fibers and have been seen by the ultra-microscope and indirectly proved by the ability of colloidal solution to penetrate to considerable extent into fibers. Heating increases these pores. The increased dyeing ability of mercerized cotton has been shown to be due to changes in colloidal state of fiber as well as its electrical charge. The effect of drying mercerized cotton is to reduce its dyeing capacity; this has been explained as being due to reversion of the changes produced by mercerization.

4. Size of dye particles. It is obvious that the extent to which dye particles can penetrate into porous substances must depend on their size. The rapidity of coagulation is also dependent on the size of the particles.

By inclusion of these four factors the electrical theory appears to explain most cases of dyeing; its value, however, lies most in cases of direct colors where chemical theories have failed.

If the dye be colloid, then coagulation results from neutralization of charge; if not colloidal, then it is ionized in solution and deposited by contact electrification charges acting on the ions.

The maximum negative charge attained by wool, silk and cotton is at 40 deg. Cent. Wool absorbs basic colors best at 40 deg. Cent.

Mention may be made of Pelet's theory of dyeing by adsorption, plus dissociation. The water of the dye bath is considered as entering into the reaction. It dissociates in the fiber into H and OH ions, which, being more mobile than the large organic ions of the dye, precede them into the fiber and deposit themselves as a film, giving it thus their charge. The dye ion, having an opposite charge, is fixed on the fiber by coagulation.

The actual existence of this "double layer" of H and OH ions on the fiber, which by selection results in the fixation of a dye accompanied by a quantitative survival of the acid in the bath, has been demonstrated not only by Pelet but by other noted experimenters.

The presentation of these theories brings this paper to a close. I reserve for a future occasion an attempt to describe step by step by physical and chemical explanations and equations the dyeing of certain typical colors.

As I stated in the beginning, the science of dyeing must content itself at present with the recording of certain phenomena which are being carried out daily according to rules derived by process of "cut and try" experiment. Even in its present incompleteness, the science is of utmost usefulness in regulating the everyday dyeing procedure.

Discussion

Chairman Lotte—I am sure Mr. Herrmann will be glad to answer any questions that you would like to ask. I am not going to take any time by making any extended remarks, but will be glad to have anyone open the discussion.

Mr. Chapin—Mr. Chairman, I would like to ask a question of Mr. Clarkson, and then one of Mr. Herrmann.

Mr. Clarkson, you mentioned 1892 as the time at which you went into the sellers' laboratory. About when did the mills begin to adopt laboratories? That is to say, when do you remember the first mill chemist?

Mr. Clarkson—The first one I went to was started in 1885 in Philadelphia.

Mr. Chapin—What mill was that?

Mr. Clarkson—The Quaker City Company. I went to the dye works first.

Mr. Chapin—I thought John Alden was perhaps the first mill chemist.

Mr. Clarkson—No, that class turned out quite a number from the Massachusetts Institute of Technology; there were John Alden, Mr. Robbins, of Amoskeag, and Mr. McFarland, who was assistant superintendent at the Quaker City when I went there; I guess you know him.

Mr. Chapin—Yes, I knew "Mac" pretty well.

Mr. Clarkson—Then the class of the next year had Chase, who was my immediate predecessor there. He went to the Arnold Print Works; now, I think, he is at one of the Rhode Island print works. John Alden at that time was with the Pacific; he never left there until he died, and Robbins never left the Amoskeag.

Mr. Chapin—You mentioned, Mr. Herrmann, the use of gelatine to make Benzopurpurine fast to acid. How permanent would that fastness be? Would it cause it to stand cross-dyeing?

Mr. Herrmann—It was really not the intention of my remark to imply that a dye could be rendered permanently fast to acid or permanently altered in its dyeing or physical characteristics by the mere inclusion or absorption of a protective colloid. It remains a fact, however, that in certain instances this fastness is permanent; as, for instance, where Benzopurpurine or even Congo is dyed on wool, and can be withdrawn from the acid dye bath as red instead of as blue or violet.

Another instance of the action of protective colloids is in the addition of glucose or carpenter's glue or gelatine to the sodium sulphide dyebath applied for cotton for sulphur colors.

I wouldn't want to be considered as thinking that one could leave silk or wool indefinitely in a sodium sulphide bath, no matter how much glue or glucose or gelatine had been added to that bath. It is a fact, however, that dyeing is actually being carried out in that manner, and it is equally a fact that this dyeing would be impossible if the protective colloid were left out.

Mr. Clarkson—In regard to the protection of Benzopurpurine, Doctor, I think I can make a statement on that.

The Farbwerke-Hoeckst got out a product they called "Solidogen," which was applied on top of the Congo, benzo and so forth that were sensitive to acid, and it was supposed to render them acid-fast. However, it didn't work out practically, but there was an attempt made to make that commercially.

Chairman Lotte—Are there any other questions?

G. H. Davis—Mr. Herrmann, could you explain the theory on the fading of colors in direct sunlight; for instance, the cotton group of colors like yellow, which is fugitive, and the Chloramine Yellow, for instance, which is fairly fast? Would you say that is caused by the ultra-violet rays in the sun, or is it explained by the difference of the fibers to the color and the effect of the sun's rays containing these ultra-violet rays upon the dyestuffs, which causes the different degrees of fading in certain lines of cotton colors?

Mr. Herrmann—I believe the matter of fading is a separate science. We know, and it has been brought out in a number of papers read before this society, that fading proceeds in a number of ways, and the results of such fading can be sometimes imitated by purely chemical or physical methods. For instance, certain dyes indicate very clearly that they fade by the process of chemical reduction. I consider it absurd to apply that one fact to all types of fading, since it is equally evident that in some cases fading is pure oxidation.

I frankly admit that I don't know what the action of ultra-violet light is. I think we will have to content ourselves more or less with the statement that ultra-violet light is a very much more energetic fading agent than ordinary light. Whether it breaks up the dye molecule in the manner that we term oxidation or reduction, or whether it causes an entirely different rearrangement or grouping of the various atoms contained in the complex dye molecule, we don't know. We can theorize that some such action takes place, particularly inasmuch as the so-called destruction of the dye is permanent.

It brings up the consideration, that I touched on in my paper, of the fact that we term many substances dyes irrespective of their chemical structure. A chemical substance is produced; the chemist engineers his manufacturing process to bring a certain number of organic groups to combine into a complex whole, which complex unit possesses a certain desired shade. It sometimes requires a very simple counteraction to break up that combination. We can do it by purely chemical means, and it appears that sunlight similarly has that action, and we call a dye fast when it resists

this action; we call it loose when it is very sensitive to the breaking-down action (which I prefer to the term "fading") of, let us say, the ultra-violet component of ordinary sunlight.

I am sorry that I cannot give you any more definite explanation, but that is my opinion of it.

Chairman Lotte—Any further questions?

Mr. Hirsch—Going back to the question of Benzopurpurine and the effect of gelatine or glue, would the addition of gelatine or glue to the dye bath have any effect in protecting Benzopurpurine from the action of mineral acids; that is, in the dyeing of cotton?

Mr. Herrmann—That very fact is made use of by the incorporation of gelatine in the dye bath, and in so far as the cotton will absorb or retain a certain amount of gelatine the dyeing will be faster. It isn't necessary to put this gelatine into the dye bath. One can after-treat the goods; and if one can introduce sufficient gelatine into the cotton and still make it commercially salable, why, the scheme is a satisfactory one.

Ordinarily, cotton sufficiently impregnated with gelatine is not considered as an attractive commodity. The gelatine itself is hydroscopic to a degree. It is washed out or removed by the first treatment with water; it is pasty; it is subject to rotting and other such destructive agencies, and for that reason the thing is not a commercially successful process. It is, however, interesting to note as illustrating the truth of the protective action of colloids of similar electrical charge, both of which combined, acting in common against a colloid or electrolyte of opposite charge.

E. L. Pickrell—Isn't it true that of the four theories that you have advanced for dyeing (the mechanical, the chemical, the colloidal and the electrical) no one of them is applicable to all dyes? In other words, one theory is applicable to certain dyes, another theory is applicable to another set of dyes, and so on all along the line. It is true that certain colors when put in solution are colloidal solutions, because, just as you said with Benzopurpurine, a protective colloid will protect it, and you can't salt it out with an ordinary salt like chlorine salt or Glauber salt. The true way of determining whether a thing is colloidal or not is by salting it out with a salt.

But you can't go ahead and apply that to all the dyes. Take a mordant dye, for instance. In other words, your colloidal theory falls down when applied to certain dyes. It is applicable to a few of them, as the various treatises on colloids have explained; your mechanical theory will apply to certain individual dyes; your electrical theory will apply to a certain class of dyes, and so on down the line. In other words, these four theories have been advanced, but no one of them is a complete theory for all dyeing.

Mr. Herrmann—I compared my paper to a patch quilt. I believe that some day the patches will all be reassembled and stitched together into something that will be a pattern that all of us can realize as truly covering the different phases of dyeing.

You are perfectly right; at least, I will say this: that I agree with you perfectly when you say that certain phases of dyeing are undoubtedly mechanical. In the case of others there seems to be some little doubt as to the chemical action—the historic instance of Rosaniline leuco base, which is colorless, yielding a characteristic red dyeing on wool. Now, if the wool acid did not supply the necessary acid radical to that leuco Rosaniline Base, a red color could not ensue.

We seem to have here a very definite proof of a certain chemical action. The fact that in many instances of acid dyes and chrome dyes, particularly those which are sulphonic acids or carbazotic acids, the acids can be quantitatively determined in the spent liquor would seem to prove that the dye base had separated from its acid, the acid remaining in the liquor, the dye being absorbed. The fact that wool can be decomposed to yield lanuginic acid, and that this lanuginic acid, in spite of the fact that it has neither fiber nor pore, will yield substantially the same result as the natural virgin wool does, would also seem to support the theory of a certain amount of chemical action.

The colloidal theory is the most beautiful of them, because it admits practically everything that the mechanical theorists say; it concedes that some dyeing is chemical, but it also studies the fiber state and the ultra-dye state, and since it has been proven by the actual passage of electric current that the dye particles possess electrical charges and that the fibers possess charges of an opposite character, it would be wrong not to admit that these charges will be half the same as they are in other arts.

The electrical theory I consider as a narrowing down to a large degree of the colloidal theory, since it does not admit anything or present anything which the colloidal theorists do not also admit, except that the colloidal theorists go a little farther into the actual ultra-particle of the dye and of the textile fiber.

Dr. Oscar R. Flynn—I must disagree with Mr. Herrmann with regard to the illustration he made with reference to Rosaniline Base. Of course, Rosaniline Base, which is comparatively colorless, does dye silk red, but I don't think that indicates any chemical action between the silk and the Rosaniline Base.

If we can shift the question to Malachite Green, for example, you can precipitate Malachite Green with caustic soda and you get a white precipitate which is taken to be the base corresponding to Malachite Green. But you can dissolve that white precipitate in cold

acid and get a colorless solution or a solution which is almost colorless, which begins to turn green, not immediately, but does turn green very rapidly when you warm the solution. So it would seem to me, in the case of Rosaniline Base and the Malachite Green, that that chemical change is simply a rearrangement of the base itself, changing possibly from the triphenylcarbinol form over to the colored form. I think really there is no doubt about that, and I don't see how you can assume that because the Rosaniline Base, which acts the same as the Malachite Green Base but whose behavior cannot be followed quite so readily—in other words, I think there is no doubt that the chemical change is not between the fiber and the base but in the base itself, changing from the colorless to the colored form.

Mr. Stott—I would like to ask Mr. Herrmann just one question: if he has formulated any theories as to the dyeing of vat dyestuffs? We all know, of course, that the vat dyestuffs themselves are insoluble in water. Treatment of hydrosulphite transfers them to the leuco compounds, in which form they have affinity for cotton, to some extent silk and wool. Does the leuco compound incline to the colloidal theory or to the mechanical theory, in your opinion?

Mr. Herrmann—Dyeing of vat colors was so beautifully explained by Dr. Wuth in a paper before this society that I would hesitate to expand on what he had to say. If you will look up that article you will find that Dr. Wuth very carefully worked out the direct colloidal behavior of the leuco vat dye and the colloidal attraction between that leuco vat dye with the textile fiber.

I think you will get very much more out of a careful reading of that than I could possibly give you, particularly since Dr. Wuth's theory follows so closely upon the general colloidal theory. If the answer is sufficient that the colloidal theory is supposed to apply, why, I will leave that with you.

Chairman Lotte—If there is no one else that has any questions to ask I think we might mention at this point that there will be no meeting during December. Our next meeting will be in January. It has been the custom in the past to have no meeting in December.

If no one else has any questions a motion to adjourn would be in order.

Mr. Howes—Before we adjourn I move to extend a rising vote of thanks to the speakers of the evening.

. . . The motion was seconded and unanimously carried, and the meeting adjourned at 9.30 p. m.

INAUGURAL MEETING OF THE SOUTHERN SECTION

The inaugural meeting of the Southern Section of the American Association of Textile Chemists and Colorists, the formation of which was authorized by the Council at its meeting on September 26, 1924, was held at the Hotel Imperial, Greenville, S. C., on Thursday evening, October 23.

Forty-nine members and guests were present at the informal dinner which preceded the meeting. Dr. E. H. Killheffer, secretary pro tem., previously appointed by the Council, called the meeting to order and after a few introductory remarks outlining the purpose and scope of the Association, introduced Brown Mahon, vice-president of the Judson Mills, Greenville, S. C., who welcomed the visiting members and guests.

Dr. Killheffer then introduced Prof. Charles S. Doggett, of Clemson College, who spoke briefly on his recollections of the development of the art of dyeing from its earliest stages.

Following Prof. Doggett's remarks, Dr. Killheffer called for nominations for officers for the new section. After having been properly nominated the following were elected by acclamation: Chairman, Brown Mahon; Vice-Chairman, John H. Carey; Treasurer, P. F. O'Neill; Secretary, Harry W. Ormand; Members of Sectional Committee: N. R. Vieira, H. L. Siever, C. H. Stone and A. W. Mungall.

Various members present made brief remarks relating to the outlook of the new section, and after some discussion it was voted to hold the next meeting in Charlotte, N. C., at some future date to be fixed by the sectional committee, after which the meeting adjourned.

HARRY W. ORMAND, Secretary.

FOURTH ANNUAL MEETING

The fourth Annual Meeting of the American Association of Textile Chemists and Colorists was held at the Bellevue-Stratford Hotel under the auspices of the Philadelphia Section, on Friday and Saturday, December 5 and 6, 1924. Detailed, verbatim reports of all the transactions held during the meeting, will be published in the Proceedings, beginning with our issue of December 29th. Pending the publication of such detailed reports, the following outline is given in order that members who were not in attendance may be advised in a general way of what took place.

Friday afternoon there were meetings of the Council and Research Committee at the Bellevue-Stratford Hotel at which some fifty applicants for membership were elected, and various subjects pertaining to the activities of the Research Committee discussed.

Friday evening an informal smoker was held in the Stratford room, which was attended by 200 or more members and guests. The feature entertainment was

furnished by M. S. Thompson who was appropriately disguised as a dyer-magician. By the simple operation of turning a crank on the outside of a dye box of his own invention, he produced marvelous colored effects in the space of one or two seconds. E. S. Bannister, managing director of the Philadelphia Textile Manufacturers' Association, spoke briefly on Philadelphia as a textile center. An exhibit of finished products furnished by leading textile manufacturers in Philadelphia was a display ranging from hosiery to rugs.

The first formal session opened at 9.30 Saturday morning. Wm. H. Cady reported for the Committee on Fastness to Light, and Hugh Christison for the Committee on Fastness to Perspiration. Wm. R. Moorhouse, who was to have reported for the Committee on Fastness to Alkalis and Acids, was unable to be present, but his typewritten report was handed to the Secretary for later publication in the Proceedings. Arthur K. Johnson then read a paper entitled: "Experiences with Micro-Organisms and Insects in Textile Work," which was discussed at considerable length. Dr. R. E. Rose, who was to have presented a paper on "Naphthol AS and BS Colors and Their Application," was prevented by illness from attending, but his paper was read by M. S. Thompson. W. W. Chase read a paper on "Mercerization of Cotton Piece Goods," and C. W. Kuhl presented a paper on "Indigosol O and other Indigosol Colors." J. S. Unterweiser presented a brief paper on the subject of "Dyeing of Three Fiber Hosiery." All of the above papers were discussed by the members at considerable length.

At the close of the discussion following Mr. Unterweiser's paper, tellers who had been engaged throughout the morning in tabulating the mail ballots for election of officers for the coming year, reported the election of the following:

President, Louis A. Olney; vice-presidents, Wm. D. Livermore and E. H. Killheffer; secretary, W. E. Hadley; treasurer, Winthrop C. Durfee; councillors to serve three years, Ralph F. Culver and A. E. Hirst.

The afternoon session convened at 2 p. m. in the auditorium of the Philadelphia Textile School. The general subject of the session was a symposium on artificial silk. Prof. Harold Hibbert of Yale University was the first speaker and described in detail the chemistry of artificial silk manufacture. He was succeeded by R. P. Dicks, president of Cupra, Inc., who discussed Cupra ammonium silk and the artificial silk industry in general. Herbert Platt, of the American Cellulose & Chemical Manufacturing Company, was the next speaker, who covered the subject of Celanese. Royal Little, of the Lustron Company, spoke on the subject of Lustron. W. O. Mitscherling, with the assistance of lantern slides, spoke on the manufacture and properties of Viscose silk. The concluding feature of the session was the operation of an artificial silk manufacturing machine by J. Brenzing, vice-president of the Max Ams Machine Company. At the close of the session, F. A. Keyser, of the Regent Knitting Mills, St. Jerome, Quebec, exhibited to the members present several beautiful examples of artificial silk knit goods produced by his mill.

The annual banquet was held in the Green Room of the Bellevue-Stratford Saturday evening, and was attended by some 200 members and guests. E. H. Killheffer acted as toastmaster, substituting at the last moment for Dr. R. E. Rose whose illness prevented his officiating in this capacity. The first speaker was Dr. Cattell, president of the Philadelphia Chamber of Commerce, who was followed by Dr. Thomas W. Davis, statistician of the city of Philadelphia. Both of these gentlemen spoke on the importance of Philadelphia as a textile center. Professor Louis A. Olney, president of the Association, was the third speaker and dwelt particularly upon the need of co-operative research in the textile world. Prof. Olney was followed by Chas. J. Webb, president of the Philadelphia Textile Manufacturers' Association, and dwelt on the scope of the textile industry and the relation of the dyestuff industry thereto. Warren E. Embley, of the United States Department of Commerce dwelt briefly upon the activities of his department with relation to the dyestuff industry. Wm. J. Wall, president of the Nicetown Dye Works, spoke on the development of artificial silk dyeing, and the speaking was brought to a close by Daniel Waters, president of the Master Dyers Association of Philadelphia, who eulogized the American dyestuff chemists for the progress which had been made in this country in the way of dyestuff manufacture since the outbreak of the war.

As was stated in the opening paragraphs, verbatim reports of all sessions will be published in the Proceedings beginning with the issue of December 29th.

APPLICANTS FOR MEMBERSHIP

Active

Folsom, Herbert A., chemist, Chemical Company of America, Providence, R. I. Sponsors: Andrew Fisher and W. H. Wingate.

Shelton, Elbert M., research chemist, Cheney Bros., South Manchester, Conn. Sponsors: Wm. K. Robbins and W. M. Scott.

Spatz, Ernest J. W., textile chemist and dyer, United Piece Dye Works, Lodi, N. J. Sponsors: E. A. F. Zillessen and E. J. Zillessen.

Active

Burke, Henry B., engineer and chemical consultant, Hussong Dyeing Machinery Company, Groveville, N. J. Sponsors: W. R. Moorhouse and H. F. Finlay.

Pfromm, John, chemist, J. H. & C. K. Eagle, Inc., Shamokin, Pa. Sponsors: James A. Branegan and Eugene W. Wall.

Wiehl, Arthur F., salesman and demonstrator, Geigy Company, Inc., New York, N. Y. Sponsors: Joseph F. Lange and D. P. Knowland.

Junior

Morrill, Elliott, assistant chemist, Dyes Distributing Corp., Chicago, Ill. Sponsors: Joseph F. Lange and D. P. Knowland.

Schwartz, Simon B., assistant superintendent cotton mill, Maginnis Cotton Mills, New Orleans, La. Sponsors: J. E. Moore and C. H. Stone.

CHANGES OF ADDRESS

Appel, William D., U. S. Bureau of Standards, Chemistry Building, Washington, D. C.

Arrow, H., 1073 Fulton Street, Brooklyn, N. Y.

Bachelder, Charles E., 12½ South Waverly Terrace, Cumberland, Md.

Bamberger, L. L., Wissahickon Avenue, Cedartown, Ga.

Dick, John B., 170 Broadway, Norwich, Conn.

Hunt, Russell W., Franklin Process Company, Philadelphia, Pa.

RESIGNED

Morrison, A. W., Cedar and Ashcroft Road, Medford, Mass.

ASSOCIATION BADGES

Those who attended the Annual Meeting at Providence had an opportunity to examine and purchase the new lapel button badges which were there distributed by the Secretary.

For the benefit of members who were unable to attend the meeting an illustration of the badge is shown herewith.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

WALTER E. HADLEY,
5 Mountain Avenue,
Maplewood, N. J.

DYEING FELT HATS

By Frederick Grove-Palmer

Soft felt hats are usually dyed when partially planked and milled, and in order to save expense a single bath is generally used.

A dye bath containing the required amount of color is made with 15 per cent of Glauber salt and raised to nearly boiling temperature. The hats, which have been well soaked in hot water, are entered and the heat maintained for about 1½ to 2 hours, until the desired shade is reached. The hats are usually sufficiently acid to exhaust the bath, but if necessary a small quantity, not more than 5 per cent of acetic acid, may be added. The dyer must make sure always to use colors that are very easy leveling for this class of work, and the use of some active penetrating agent, such as tetracarnit would be of great value.

For black the Naphthalene and Acid blacks, appropriately tinted with a little green and yellow, are very successful. Practice shows that 10 to 12 per cent of black and one-quarter per cent of each of the shades will give excellent results. When a specially good black is required on hats which shall be fast to light, water, alkali, hot pressing and perspiration, one of the Chrome Blacks is preferred.

In this case the hats are worked in the bath made as before until thoroughly penetrated, then ¼ to ½ ounce of acetic acid is added for each pound of felt; the temperature is kept at the boil until the bath is exhausted. The hats are lifted, and 1 per cent of bichromate put in; the hats are re-entered and worked at the boil for one-half an hour.

After dyeing it is, of course, necessary that the hats should be well washed and hydro-extracted to insure that there is no excess of dye or acid left behind. As regards the choice of colors, the dyer should let himself be guided by the manufacturers; in the first place, as to the suitability of any special dyestuff, and he should then verify that information by experiment in his own plant.

A MODERN DYEING PLANT

The construction of the plant of the Textile Dyeing Company of America, Inc., in Hawthorne, N. J., has been completed and operation has started.

The plant, which occupies a floor space of 140,000 square feet, is situated at Wageraw Road and Maple Avenue on a 42-acre estate skirting the Passaic River. On this property there is a large lake with an overflow of 2,000,000 gallons of water in every twenty-four hours. It passes through an extensive filtering and water softening apparatus installed by the Permutit Company. In addition, there are artesian wells having a depth of approximately 400 feet each, mounted with electric pumps drawing about 1,000 gallons of artesian water a minute. Oil-burning burners having a capacity of 1,600 h.p. operate the entire plant.

The plant is equipped to give a service founded upon years of practical experience in the art of weighting and dyeing. Its working staff includes specially trained chemists and dyers familiar with the weighting processes in which the company will specialize. The machinery, some of which was built abroad, is specially constructed and of the latest type. Every detail involved in the processing of textiles and particularly in the weighting and dyeing of silk piece goods has been provided for.

The company, in close adherence to its belief in a healthful, cheerful atmosphere as an important factor in efficient production, has installed showers, lockers, dressing rooms and a large dining hall in an endeavor to provide the best possible conditions for their employees to work in.

Robert Wyder, treasurer of the Silk Finishing Company of America, is president and treasurer of the Textile Dyeing Company of America, Inc. Rudolph Doherr, Mr. Wyder's son-in-law, is the secretary of the new concern.

Dr. Victor Froehlicher and August Haberlin, both of whom have had experience in weighting and dyeing in this country and abroad, are in charge of the concern. Willi Labhard, who also has had special training, will be the outside representative.

Willi Koller, of Thalwyl, Switzerland, was the designer and supervising engineer. He was commissioned by the organizers, who operate similar large dyeing plants abroad, such as the Weidmann Silk Dyeing Company, Thalwyl, Stuckfarberei Zurich, and the Seidenstoffappretur Zurich, all of Switzerland.

SPRING COLORS FOR SHOES

The Textile Color Card Association has issued a card showing the six new shoe and leather colors for next spring: Priscilla, a silver gray; English gray, Sudan, Madrid and Vassar tan (two browns) and Rugby tan.

At Woonsocket, R. I., a charter has been granted to the Hilsar Dyeing & Finishing Corporation, headed by Richard J. Hill. The new company has a capital stock of $50,000. R. W. Pierce, of Providence, is treasurer, and A. Howard, of Pawtucket, is secretary. The company has leased two floors of the plant of the Leicester Knitting Company at Woonsocket, and expects to start operations at once, with fifteen to twenty hands employed. The company will dye and finish woolen and worsted goods, knit goods, etc. Mr. Hill has been in the dyeing and finishing business for thirty years. He was at one time superintendent of the Washington Mill of the American Woolen Company at Lawrence, was superintendent of a mill at Maynard, Mass., for four years, and was also connected with the Globe Mills at Utica, N. Y. He has been in Woonsocket for many years. For ten years he was at the plant of the Dunn Worsted Company, and has also held positions with the Enterprise Dye Works and the Goldmark Knitting Company, of that city.

MEN OF MARK IN THE DYESTUFF FIELD

HARRISON F. WILMOT

Technical Adviser to the Synthetic Organic Chemical Manufacturers Association of the United States

HARRISON F. WILMOT was born in 1888 in the small town of Moncton, New Brunswick, where he attended the local grammar and high schools. After leaving high school he completed the special course in chemistry, dyeing and engineering at the Bradford Durfee Textile School, graduating with the class of 1911.

The next two years were spent as colorist with the following mills: The Algonquin Printing Company, Fall River, Mass.; D. A. Higgins Dye Works, Edgewater, N. J.; Davis & Quick, Brooklyn, N. Y. For three years following he was employed as color chemist in the New York laboratory of the Kalle Dyestuffs & Chemical Company whence he joined William Beckers Aniline & Chemical Works as chemist in charge of the Boston laboratory, and later as salesman and demonstrator in the New England territory. During 1918 he was vice-president of S. R. David & Co., of Boston.

In 1919 he organized the TincTura Laboratories, Inc., of Brooklyn, N. Y., and for three years thereafter was president and director thereof.

In 1922 he was appointed technical adviser to the Synthetic Organic Chemical Manufacturers Association of the United States, an organization which includes a majority of the chemical, dyestuff and pharmaceutical manufacturers of the country, to which office he was recently re-elected for the third successive term. In this capacity he has supplied the Government's attorneys with technical information which has been of great assistance in the winning of practically all cases coming before the customs courts in which dyestuff importations have been involved.

Mr. Wilmot is a member of the American Chemical Society, Chemists Club, treasurer of the New York Section of the American Association of Textile Chemists and Colorists, and third vice-president of the Salesmen's Association of the American Chemical Industry.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

CLAYTON HOAGLAND
Managing Editor

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COLOR TRADE JOURNAL CHANGES HANDS

THE Color Trade Journal, of which Dr. J. Merritt Matthews, the well-known authority on Textile Chemical subjects, is editor, and of which he was until recently sole owner, has been sold by him to Miss M. N. Conklin and J. Carlisle Lord. Miss Conklin has for many years acted as managing editor of the paper for Dr. Matthews. Mr. Lord is an advertising man of considerable experience.

The Color Trade Journal was founded in 1917 by Dr. Matthews and C. Cyril Bennett. In the summer of 1920 Dr. Matthews acquired from Mr. Bennett his controlling interest in the publication, and has continued to own it until the recent sale to Miss Conklin and Mr. Lord. We understand that a contract has been made with Dr. Matthews whereby he will continue to act as editor of the publication for a long period of years.

The REPORTER wishes to take this opportunity to felicitate Miss Conklin and Mr. Lord upon their purchase of the property and to wish them all success.

CO-OPERATE—FOR PROFIT AND PROTECTION

IN an address before the recent annual meeting of the Salesmen's Association of the Chemical Industry, Dr. F. E. Breithut made a strong appeal for the immediate organization of an American dye cartel, deploring the sharp competition prevailing in the dyestuff manufacturing industry. Dr. Breithut recently completed an exhaustive survey of the dye industries of the world. What he said in his address was doubtless supported in his mind by knowledge of conditions as they exist in the dye industry, not alone of the United States, but of Germany, of Switzerland, of England, of France and Italy. With this fact in mind we cannot ignore Dr. Breithut's appeal.

Dr. Breithut alluded to the sociable atmosphere in which the German dyestuff industry grew to such enviable proportions, and emphasized the urgent necessity of a similar understanding among our own dye manufacturers.

"What we need without delay," he stated, "is a big trust headed by a Gary or a Schwab. . . . We have here in abundance all the raw materials necessary to make us the greatest chemical-producing nation on earth. But despite all our talk, we are not the greatest. Wherever mass production can be applied we are all right, but elsewhere we are not so good.

"Why? Well, one of the reasons is that we do not take the public into our confidence. The dye manufacturer in America doesn't let the other fellow in on the economic facts behind his business. He doesn't sell his enterprise?"

It is good to see a man of Dr. Breithut's experience stand up and say in a very straightforward manner what is in his mind regarding the conditions in our dye industry. The dyestuff men who heard him without doubt could not have failed to comprehend the full weight of his argument for an American dye trust, must have gone still further and thought about many things he did not say. It is good that a man of such prominence in our industry affirmed what was probably already in the minds of these men, affirmed and added strength to the many, many protestations against the ruinous competition that now prevents our industry from prospering to its fullest extent. All this is commendable in Dr. Breithut, but how much more commendable it is that he offers a logical solution to the evils he describes. Even though it seems at present an unattainable solution, yet how fine a thing it is that it is even proposed, discussed and hoped for by some.

But it is truly regrettable that our dyestuff manufacturers as a whole show considerable lack of foresight in not responding to such an appeal with a more intense desire to actually test Dr. Breithut's proposal for an American dye cartel. We know that the present Sherman anti-trust law obviously presents an unsurmountable barrier to any move for concerted effort on the part of our dye industry. We know that there exists among the majority of dyestuff men an underlying prejudice against any form of combination of interests at the present time. The manufacturers, in short, while regarding as impossible any attempt at organizing the industry, strangely overlook the possibility that some day they may be forced into such an alliance for self-protection.

At the present time Germany is not such an active competitor in the world's dye trade as she will be when her financial and industrial systems are running more smoothly. Thus her present efforts do not supply an urgent incentive for our dye manufacturer to protect and improve his industry. He feels that he is adequately protected by an unusually strong tariff wall. Though his business suffers to some degree from those foreign colors that break through this tariff, yet he

does not feel this outside competition nearly as much as the competition in the domestic market. This naturally breeds a strong commercial rivalry that tends to smother any idea of *co-operation* with his competitors. Such a proposal, even from a man like Dr. Breithut, seems to him utterly impossible of realization. But taking all of this into consideration, is it not likely that some day the strong position of our dye industry will be attacked and shaken, perhaps by adverse tariff legislation, perhaps by an even greater foreign competition? Under such not unlikely conditions the existing brand of competition would loom as an extremely undesirable evil. It would then be revealed, in all its pernicious force, tearing at the very foundations of our industry—unit fighting unit for a few cents per pound and amid the general turmoil the combatants themselves presenting the sorry spectacle of being slowly vanquished by outside competition. Too late then to consider brotherly love within our industry; too late then to try to smother a commercial antagonism that will have become so deep-rooted as possibly to have encompassed nine-tenths of our domestic dye trade.

Now, while we are so well protected at home and while foreign competitors are engaged with their own problems of finance, labor and production, now is the time to lay actual plans, not nebulous dreams nor mere speculations, of a future American dye industry, co-operatively organized and presenting an invulnerable front to adverse legislation and foreign competition alike. By combining our large and powerful dye-producing units for maximum efficiency and minimum overhead, and thus abolishing wasteful duplicate production of colors and making possible the purchase of huge quantities of raw materials at rock-bottom prices; by skillfully organizing our sales armies and thus abolishing at one stroke price wars and expensive duplicate marketing efforts, the American dye industry could face the future contentedly and with the wonderful realization that no inside nor outside force could tilt it from its foundation. Such an organization would mean that research activities could be extended to a degree never before dreamed of. It would mean the production of higher quality dyes at considerably lower cost. It would mean that the industry would be in a position to assure the consumer of a service more rapid and satisfactory in every detail and of products equaling any of foreign make.

Although the projection of such a mighty plan would be fraught with countless obstacles it does not seem, upon reflection, entirely hopeless of realization. Perhaps if our dye industry were so squeezed that immediate combination of units was an absolute necessity some compromising or discriminatory amendment to the existing trust laws would make possible, in the interests of the American dyestuff industry and of national defense, the formation of a powerful dye trust directed by the leaders in the industry and controlled to some extent by governmental legislation.

But such speculations are not definite enough at this time to afford more than a slight hope for some cessation of the competition so widely deplored. What is more direct, what offers a more logical incentive is an appeal to the dyestuff manufacturer's judgment. By pointing out the futility of the present competitive tactics—by reminding him that his secure though not excessively profitable position may not last forever, may, and probably will be, seriously weakened—perhaps he may in time become more intelligently responsive to these appeals for mutual confidence and co-operation in his industry. Surely he cannot fail to recognize that cutthroat competition in *any* industry is extremely unscientific. And even though prospects of the immediate formation of a cartel are almost nil, he cannot afford to ignore the tremendous advantages that lie on the side of efficient co-operation and a fundamental understanding among the individual members of his industry.

SIR WILLIAM ALEXANDER VISITS AMERICA

Sir William Alexander, one of the outstanding figures in British chemical circles, is paying a brief visit to America in order, primarily, to get in closer touch with his interests in the American companies which are marketing Celanese and the S. R. A. dyes. Sir William is Chairman of the British Dyestuffs Corporation, Managing Director of Tennant's, Ltd., President of the American-British Chemical Supplies, Inc., and a director of the American Cellulose & Chemical Manufacturing Company. He has also recently been returned as a member of Parliament from the Central Glasgow district.

In a brief interview with the publisher of The Reporter, Sir William emphasized his belief that artificial silk would become the leading textile fiber of the future; that it would excel real silk in beauty, strength and durability, and would be obtainable at prices materially less than natural fibers.

Speaking of the proposed agreement between the British Dyestuffs Corporation and the Interessen Germeinschaft, which has been indefinitely tabled because of opposition arising from various British sources, he said he believed the arrangement, as proposed, would be extremely beneficial not only to the British Dyestuffs Corporation, but to all British consumers of dyestuffs. He pointed out that the agreement did not contemplate the cessation of creative research by British chemists but that, on the contrary, it would release these chemists from labors aimed at duplicating products currently manufactured in Germany and enable them to devote their whole energies toward the production of entirely new colors and processes of application.

Sir William believes in close co-operation between all large manufacturers of chemicals, holding that by

such co-operation broader markets may be developed and production costs decreased; that as commodity prices are lowered consumption automatically increases. In other words, the world seems to have about so much money to spend for various commodities, and as these become cheaper, greater quantities will be consumed.

Sir William has been the recipient of much attention from leading figures in American chemical circles, and his forceful personality, clear thinking and logical argument have impressed most favorably all who have had the pleasure of making his acquaintance.

DOUBLING FIGURES—AN INDEX TO PRESENT CONDITIONS

THE Trade Record of the National City Bank states that manufactures are the chief factor in the surprising growth which the exports of the United State are making in the calendar year 1924. Latest official reports indicate that the exports of the current year will exceed those of last year by nearly two hundred million dollars and be practically double those of the year preceding the war. Of this prospective gain manufactures alone seem likely to form the largest share. The prospects are that the total value of manufactures exported in the calendar year 1924 will approximate $2,200,000,000 against $1,100,000,000 in the fiscal year 1914.

Such figures as these contradict prevailing reports of curtailed production in manufacturing. We know that some industries have suffered recently; we know that some show heavy losses due to weakening of demand in certain lines. But again it is the old story of the interdependence of all industries in each country the world over.

Manufacturing in the United States is carried on in such mammoth proportions that often it takes three or four months for an overproduction of goods to show its effect on the general market. But were all our manufactures poured into *domestic* markets an industrial cataclysm would long before now have been brought about. Fortunate we are that our foodstuffs, our textiles, our machinery is of such excellent character as to be desired by the population of Canada, England, France, Germany, China and South America in such increasing quantities.

When our exports double in ten years there can be little danger of permanent overproduction. Were *imports* to double and exports to drop, then might there be some cause to fear continued depression. But the latest figures show the excess of exports over imports to be greater this year than in any pre-war year and four times that of last year. Does it sound too optimistic to predict a still greater year for 1925?

INQUIRY DEPARTMENT

The S. H. Co.—Question: On page 445 of your June 30th issue is a very unique article in answer to an inquiry on the cause of fuzziness and "lousiness" on silk during dyeing.

If you could obtain some further information for us, perhaps from the author himself, upon certain points indicated in his letter, we would deem it a favor. In the next to last paragraph he speaks of "cohesion tests, boil-off and ash determinations" as a means of discovering inherent fuzziness and lousiness. We would like to know especially just what he means by a cohesion test, how it is carried out, and after such a test what would be the appearance of the silk possessing the former undesirable qualities as compared with good silk.

Does a practical dye test refer merely to a dyed sample or a specially dyed or weighted one?

The author evidently has done some investigation of a biological nature, and, if he is willing to give it, I should like to have his opinion as to why silk "louse" spots have a selective character toward dyestuffs such as that approaching cotton, a carbohydrate than that of silk, a proteid?

Answer: The cohesion test is a test originated by Warren P. Seem, who was at that time in the employ of your company so that the details are undoubtedly available in your files.

Silk inclined to be lousy would produce broken ends in a much smaller number of strokes than a firm, dense silk, although the separation of fibers without breaking is dependent on the tenacity of the gum.

The boil-off test is the standard boil-off established by the Silk Association. It consists of two boilings, of one-half hour each, with 25 per cent (of the weight of the silk) green olive oil soap. The appearance of the rinsed and dried test-skein will indicate somewhat the nature of the silk.

Ash determinations merely indicate the amount of mineral matter present in the fiber, and, if not added purposely, will indicate whether or not the silk is deficient in this respect. Ash is not merely an incidental—all biological products contain mineral matter as an essential ingredient.

A dye test means an arbitrary test made under uniform conditions for all the samples under observation.

The spots called silk lice are not in any way less highly colored than the normal fibers, as an examination under a microscope at 100 diameters will show. Their light color is due to their fine state of division and the diffraction of light, just as the powder of black glass or the foam of ink, is white. Their chemical nature is unaltered but they differ physically and, hence, have different optical properties.

M. Co.—Question: We enclose herewith a small sample of 12-ounce duck dyed brown. We believe it is a wood dye. Could you tell us whether it is or not, and if it is, suggest a dyeing formula for this shade?

Answer: The limited experimentations possible because of the small size of the swatch submitted have established that this cloth was not dyed with cutch, nor with sulphur colors, nor is it a mineral khaki shade. It may have been dyed with fustic and quercitron.

If you wish to duplicate the shade we would suggest using sulphur colors as being the most satisfactory from all standpoints. If you will send a swatch to any of the large dyestuff manufacturers or dealers, asking for a formula to match the shade with sulphur colors, they will unquestionably be able to assist you.

R. D. R.—Question: We understand that all vat dyestuffs have recently been classified an "Indanthrene" or "Anthra"—the former name representing the very fastest colors independent of their chemical derivation. Can you tell us who is the authority for this classification and is it generally accepted?

Also, is there any available tabulation of the vat colors arranged according to the above classification and independent of the particular manufacturer of each color? If so, can you supply this tabulation?

We will greatly appreciate any information you can furnish us regarding the foregoing.

Answer: The term "Indanthrene" is applied to a certain selection of the former Algole, Helindone and Indanthrene colors, the colors now classed as Indanthrene being the fastest of each series. This classification was agreed upon by the respective manufacturers of each type and is now generally accepted. The balance of the Algole and Helindone lines not included in the Indanthrene classification are still known as Algole and Helindone. The balance of the Indanthrene line not now included in this classification are known as Anthra; in other words, the term Anthra applies only to the less fast of the Badische vat colors.

A complete list of the colors now known as Indanthrene, together with their old names, is enclosed herewith. Where no old name appears, the name is the same as that previously used.

INDANTHRENE DYESTUFFS

New Name	Old Name
YELLOW	
Indanthrene Yellow GK	Algole Yellow R
Indanthrene Yellow G	Indanthrene Yellow G Helindone Yellow IG
Indanthrene Yellow RK	Helindone Yellow RN
Indanthrene Yellow 3RT	Helindone Yellow 3RN
ORANGE	
Indanthrene Gold Orange G	Indanthrene Gold Orange G Helindone Gold Orange IG
Indanthrene Orange RRK	Algole Brilliant Orange FR
Indanthrene Orange RRT	Indanthrene Gold Orange RRT Helindone Gold Orange IRRT
Indanthrene Orange 3R	Indanthrene Gold Orange 3R
Indanthrene Orange 4R	Indanthrene Scarlet GS
Indanthrene Orange 6RTK	Algole Orange R
RED	
Indanthrene Red 5GK	Algole Red 5G
Indanthrene Red RK	Indanthrene Red BN Extra Helindone Red IBN Extra
Indanthrene Pink B	
Indanthrene Red Violet RRK	Indanthrene Red Violet RRN
Indanthrene Red Violet RH	Helindone Red 3B
Indanthrene Corinth RK	Algole Corinth R
VIOLET	
Indanthrene Brilliant Violet RR	Indanthrene Violet RR Extra Helindone Violet IRR Extra
Indanthrene Brilliant Violet RK	Algole Brilliant Violet R
Indanthrene Brilliant Violet BBK	Algole Brilliant Violet 2B
Indanthrene Violet B	Indanthrene Violet B Extra
Indanthrene Violet BN	Indanthrene Violet BN Extra
BLUE	
Indanthrene Dark Blue BO	Indanthrene Dark Blue BO Helindone Dark Blue IBO
Indanthrene Dark Blue BOA	Indanthrene Dark Blue BOA Helindone Dark Blue IBOA
Indanthrene Dark Blue BGO	
Indanthrene Blue RK	Algole Blue K
Indanthrene Blue RC	
Indanthrene Blue RS	
Indanthrene Blue BCS	
Indanthrene Blue GC	Indanthrene Blue GC Algole Blue C
Indanthrene Blue GCD	
Indanthrene Blue 3G	
Indanthrene Blue 3GT	Algole Blue CF
Indanthrene Blue 5G	Algole Blue 3G
Indanthrene Brilliant Blue R	
GREEN	
Indanthrene Blue Green B	Indanthrene Blue Green B Helindone Blue Green IB
Indanthrene Green BB	Algole Green B
Indanthrene Green G	
Indanthrene Green GG	
BROWN, OLIVE	
Indanthrene Red Brown R	
Indanthrene Brown 3R	
Indanthrene Brown R	Algole Brown R
Indanthrene Brown T	
Indanthrene Brown GG	
Indanthrene Brown GR	Helindone Brown AN
Indanthrene Brown G	Algole Brown G
Indanthrene Olive R	Algole Olive R
GRAY, BLACK	
Indanthrene Gray BTR	
Indanthrene Gray RRH	
Indanthrene Gray K	Algole Gray B
Indanthrene Gray GK	Algole Gray 2B
Indanthrene Gray 3B	
Indanthrene Gray 6B	Helindone Gray BB
Indanthrene Black BGA	Indanthrene Black BGA Helindone Black IBGA
Indanthrene Gray BB	Indanthrene Black BB Helindone Black IBB

H. E. F.—Question: I color ladies hand bags, pocketbooks and bill folds in three-tone shades, mostly browns, greens and deep yellows, applying the dye with an air brush, and while I am getting fairly good results, yet am not satisfied.

Am using liquid carbonic acid gas in the air brush, and alcohol soluble basic dyes. Water soluble dyes, on account of the water penetration not permitting the density of the coloring to show until evaporated, cannot be used.

I am striving for that degree of excellence attained by ————, of Buffalo, N. Y., in this line of leather work.

Am submitting my entire problem to you in the shape of questions as follows:

Leather.—What tonnage (or trade name and tanner if brown) of leather is best suited for this class of leather work and air brush application of the dyes? Should the leather be processed before dyeing, as soda ash or acid; if so, what processing is best?

Dyes.—What kind or class of dyes is best suited for this kind of leather dyeing, meaning natural dyestuffs, dyewoods, or aniline, etc. Requirements are: Fast to light and water, and alcohol soluble. If artificial, basic, or acid? Browns, greens and deep yellows are mostly used. For the kind, or class best suited, what proof alcohol is best—full 188 proof, or less?

Application.—With the dyes best suited, will the use of carbonic acid gas through the air brush, instead of compressed air, have an injurious effect?

As before stated, I am striving for the excellence of ————, of Buffalo, N. Y., and if their process, methods and kind of leather used are unknown and a trade secret, then I will need all the information I can get, as I am going to turn out just as good work, but if it is known, then I can be saved many a hard knock and bump and will certainly appreciate it if you will help me as much as you can and in terms a non-technical man can grasp.

Any information you can give me will be deeply appreciated.

Answer: The class of work in which you are engaging appears to be much more of an art than a science. There is apparently little or no literature available on the subject, and each concern has certain "tricks" or "secrets" which it regards as its own property.

In a general way, however, we might say that various leathers are used, such as skivers, quebracho sheep, bark-tanned calf and bark-tanned cowhide (side leather). We assume that any of these leathers which you might purchase, would have been sufficiently processed before they reached your hands, and that they would require nothing more than cleaning with gasoline if they were at all oily.

Dyes to be used are either acid or basic. Of the two, the basic colors are generally far more soluble and also more brilliant. They are usually, however, not so fast to light as acid colors. For dull background shades the acid colors are generally superior. These can then be overlaid, if so desired, with the brighter basic colors.

It is not necessary or desirable to use pure alcohol. A solution of 50 per cent alcohol and 50 per cent water would be a fair average. This, however, can be varied at will, depending upon the ease with which penetration occurs on the different leathers. This can be determined by experimentation and a careful observation of the results. A high percentage of alcohol dries and stiffens the leather to no advantage. Generally speaking, the heavier and greasier the skin, the higher the percentage of alcohol that is required. When working on a clean, light leather, a percentage as low as 25 per cent alcohol and 75 per cent water might be employed.

Carbonic acid gas is quite O. K. to use in an air brush and will in no way affect the properties of the dyestuff. It is desirable because of its reducing the danger of fire.

We are unable to give you information as to the processes employed by the particular manufacturers whom you mention, but feel that careful experimentation ought to enable you to produce satisfactory results.

W. W. Co.—Question: I dye a quality of chiffon like the enclosed sample. With every precaution I have taken the edges of this chiffon curl. I have tried degumming on strings on the hand reel and overreal, fully degumming and partly degumming. I have also tried rolling pieces on a roller, boiling before stripping, over night, and degumming afterward. In spite of these precautions the edges curl when the raw pieces touch either hot or cold water. The finisher is unable to remove this curl, although I have been told that it is his duty to remedy the defect.

Answer: We have carefully examined the samples enclosed with your letter and have concluded that the trouble probably has its source in the weaving of the fabric. The excessive tightness of the selvage could cause such a curl. We would suggest degumming with diastafor; this may possibly remedy the trouble. In any case, the trouble is not in the dyeing and should be overcome before the cloth reaches the dyer. It is highly probable that the designer of the cloth is at fault and should be consulted. A slight change in the design and weave ought to eliminate the curl of the edges.

DYE APPLICATION IN CHINA

(*Continued from page* 816)

in a 3 per cent depth of shade, at a boil, without salt or soda. A standing bath is often used.

Direct Blue, either as sky blue or navies, is used as a cheap substitute for indigo. Dyeing is done at a boil without dyeing assistants. Drying is done in the open air but on covered racks.

A golden yellow, the former imperial color, finds a use in decorative materials, and for parts of children's clothing. Chrysophenine G is the most popular color for producing it.

A fairly wide range of shades are produced on cotton, but as they are usually applied to yarn we shall consider them under that heading.

Vegetable Colors on Cotton Cloth

Besides black, yellow is the only color at present applied to cotton, and this only to a small extent. The source of the color is a kind of grain resembling wheat, called *whei mei.* The color principle is removed by steeping in water. Application is the same as for Vegetable Black on an iron mordant.

Frequently this yellow is combined with indigo to form a green.

Dyeing of Cotton Yarn

The bulk of the yarn dyed in China—and yarn dyeing in connection with hand loom weaving is a very large factor in the dye consumption of the country—is dyed with indigo. Next comes Sulphur Black, and then numerous direct and basic colors which are used alone and in combination to give a large variety of fancy shades.

Sulphur Black—Japanese Method

Although throughout the country as a whole Sulphur Black is applied to yarn in the same general manner as to cloth, the Japanese have introduced in some places a modified dye vat which merits description. This vat is all of cast iron, cylindrical with a rounded bottom, with a capacity of only about twenty gallons, and is set over a fireplace. It is customary to place several such vats in a row about one foot apart. The yarn is hung on wooden stocks resting on the top of the vat. This method of handling the yarn more nearly approaches Western practice.

The advantages claimed are: (1) Less tangling of the yarn, and (2) a shorter dye liquor—facts which some Chinese dyehouses have been quick to appreciate.

Usual Chinese Method

On the whole, however, yarn dyeing is carried on throughout the country in the usual brick bath with an iron bottom.

Twenty per cent of color with half as much sulphide is the standard starting bath. This works out to an 8 or 10 per cent standing bath.

The principal fault with this dyeing as with the piece goods is lack of proper washing. The wash water has to be drawn by hand and perhaps carried some distance in buckets by the workmen, so the tendency is to cut this form of labor to a minimum.

Direct Colors

Red was formerly very largely used on trousers of the peasant women, and for both trousers and jackets of children. Black is gradually replacing red, since it is a more serviceable shade, and the Sulphur Black used does not need redyeing as often as the Direct Red In pre-war days Benzopurpurine 4B and Congo Red 4B shared the demand for this class of dyestuff. The great increase in the price of all colors from 1914 to 1920 reacted more strongly against Benzopurpurine. Congo was the first direct red to reappear in China. Benzopurpurine returned later but at a considerable difference in price. Although prices for the most part are now about pre-war figures, there is still a difference between the two reds which is sufficient to keep Benzopurpurine out of general use. With a general tendency for a decrease in the use of Direct Reds, Benzopurpurine will probably never again be an appreciable factor in the dye consumption of the country.

There is a small demand for Direct Brown of the general shade of Triazol Brown 3G. This is used in ginghams for ladies' and children's clothing, bed coverings and similar uses.

Some Garnet is consumed which takes a little color such as Congo Corinth, although equally as much of this shade is produced by mixtures of Direct Blue and Red.

Yellow is used. Chrysophenine G is the usual direct color. A brighter shade is usually preferable, which means that Auramine O is applied.

The only important direct colors on cotton are Direct Red and Blue. There is little of technical interest in their dyeing. Application is at a boil in the usual form of kettle set over a fire. No salt or soda is used. The most common practice is to throw the skeins into the dye vat and stir them around just sufficiently to insure even dyeing with the minimum of tangling. Sizing and natural impurities are usually removed by a preliminary boil with soda ash and a subsequent pounding with sticks, followed by a rinse. In drying it is customary to protect the racks with reed mats from direct sun.

Basic Colors on Cotton

Violet, green, red, blue and yellow are used, violet having the most demand and yellow the least.

Dyeing is usually carried out cold in a kong, previously mordanting with vegetable materials containing tannin and fixing with iron. Sometimes the basic colors are "topped" on direct colors of approximately the same shade. Cases have been noted where it was customary to dye hot without previous mordanting, an addition of alum and native vinegar being made to the dye bath.

(To be concluded)

The artificial silk industry has made surprising progress during the past six years, according to a recent report covering production figures for this young but extremely active member of the textile family. Despite general dullness in the textile industry during the past months, the artificial silk production for this year, it is estimated, will reach a total of 40,000,000 pounds, a jump of 567 per cent since 1918. Steady progress during the coming year is predicted by leaders in the industry. Demand for artificial silks has greatly exceeded the supply, and shortages of certain of the coarser grades have been reported.

The Shop Early, Mail Early Campaign inaugurated by Postmaster General New last year proved to be an unqualified success. It was of great benefit to the people and also enabled post office employees to deliver all the Christmas mail before noon on December 25. The Department again this year asks the hearty co-operation of the public in order that the record made last year may be equalled, if not excelled.

TWO NEW AND IMPORTANT DU PONT COLORS

The Dyestuffs Department of E. I. du Pont de Nemours & Co. announces the development and placing on the market of two colors not hitherto produced by domestic manufacturers. One is a vat color known at Sulfanthrene Orange R Paste and is similar in shades and properties to a color previously imported and known as Hydron Orange R (Cassella). This vat color dyed on cotton gives bright shades of reddish orange of excellent fastness to washing and chlorine. Its fastness-to-light is similar to that of other colors of the Sulfanthrene series. Its principal use, it is stated, is for dyeing ginghams and shirtings where laundering fastness is the main requirement, and for goods which are to be subsequently bleached in the piece, as this bleaching has very little effect upon the shade. It is announced that it can be dyed on warps, yarns, or pieces, as a self-shade or in combination with other colors of the same series.

The announcement calls especial attention to the fact that sulphonated oil should not be used in the dye bath with this color, as it will be precipitated by the oil and the shade will be duller and weaker. The color, it is stated, is also suitable for calico printing and for shading Sulfanthrene Scarlet BB Paste or other similar colors for producing bright shades, and can be used either for direct or discharge printing with equal success.

The other color announced by the Du Pont Company is Sulfanthrene Scarlet BB Paste which is similar in shade and properties to a color previously imported known as Hydron Scarlet BB (Cassella). Sulfanthrene Scarlet BB Paste in shade is a bluish scarlet which, it is stated, can be used for self-shades or in combination. It will stand severe laundering without change of shade and without bleeding. The company's announcement states that its fastness-to-chlorine, cross-dyeing, perspiration and water is also very good. In light fastness it compares in general with the other colors of the Sulfanthrene series. It is very soluble and very level-dyeing, and is especially suitable for dyeing yarns for ginghams, dress goods, shirtings and other fabrics where fastness in laundering and washing is the principal requirement. The color is an extremely important one for printing and can be used to a large extent for producing bright reds and scarlets. It is especially recommended for calico printers.

A CATALOGUE THAT IS SOMETHING MORE

"The Tag Textile Catalogue" is the title of a new fifty-page magazine-size booklet issued by the C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y. Primarily it is a catalogue of indicating, recording and controlling instruments used in dyeing, bleaching, warp sizing, scouring, drying, air conditioning and other textile processes. Merely the fact that its contents were compiled exclusively for the textile industry makes this catalogue considerably more interesting and valuable than a general catalogue of miscellaneous instruments. But this particular catalogue is almost an elementary textbook on temperature engineering and its place in the textile industry. It contains several semi-technical illustrated articles on dyeing, scouring, sizing and drying. These articles treat of the close relationship of temperature-time control to the ultimate success of each operation in the processing of textiles, and present information of a nature not usually found in such catalogues.

Temperature control in dyeing or in scouring or warp sizing is not such a well-understood subject as to render new literature of only passing interest. When a company that has been specializing in temperature engineering for the textile industry since 1769 issues a booklet designed to impart such practical information as it has gathered during its years of experience and contact with the technical problems involved, it is almost certain that this information will be of a highly practical and authoritative nature. And when it is presented clearly and concisely in the form of magazine articles written in a style not intended solely for temperature-control experts, and admirably well printed and illustrated and condensed within the pages of a serviceable catalogue, that information becomes of very great interest to every dyer who is ambitious to acquire a more thorough knowledge of temperature control.

The booklet opens with a brief introduction explaining the purpose of the catalogue, followed by simplified flow charts of the cotton and woolen industries and two pages briefly describing the principal TAG indicating, recording and controlling instruments. The first article on dyeing is divided into sections headed "A Man-size Job," "Dyeing as an Exact Science," "Overcoming Difficulties," "The Most Important Word in Dyeing" and "What Does 'Control' Imply?" The article which follows treats of the application of temperature-time control instruments in piece dyeing and their functions in securing best results. The instruments used are illustrated and specifications are given for each. In like manner are presented articles on miscellaneous dyeing, wool scouring, warp sizing and drying. The two center pages describe briefly, under their individual headings, the application of automatic control instruments in boiling out and bleaching, mercerization, crabbing, aging, fulling, etc. There is also an article on air conditioning—"A Problem in Relative Humidity Control."

The last twenty pages of the catalogue are devoted to detailed descriptions of the temperature-control instruments manufactured by the Tagliabue company. Each instrument and its principal parts are illustrated and the exact working of the instrument fully explained.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

NAPHTHOL BLACK B

(Schultz No. 272)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool pieces, hats, etc. Not suitable for loose wool, as it does not cover the tips.

USUAL METHOD OF DYEING: Glauber salt and sulphuric.

SHADE: Bright bluish black.

SHADE BY GASLIGHT: Very little change in shade.

SOLUBILITY: Fair.

LEVEL: Dyes level in blacks.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Fast.
Alkali: Changes shade and bleeds into whites.
Carbonizing: Changes shade very slightly.
Fulling: Best of the Acid Blacks, though the shade changes slightly; and it also bleeds into the whites a little.
Ironing: Fast.
Light: Best of the Acid Blacks.
Perspiration: Fast.
Potting: Bleeds.
Rubbing: Very fast to rubbing.
Scouring: Changes shade very slightly in neutral soap.
Steaming: Fast.
Sulphur: Very slight change in shade; no bleeding.
Washing: Will stand a neutral soap at 60 deg. Cent. without changing shade.
Water: Does not bleed in cold water.

OTHER PROPERTIES: Largely used for the production of Acid Navy Blues in conjunction with Acid Violet 6BN (S-548).

DYED BY OTHER METHODS: Can be top-chromed, as the shade does not alter much.

ON UNIONS: Cotton-effect threads are left white when cloth is dyed acid. Wool-silk unions: The silk is left very light.

ON OTHER MATERIALS: Paper: Suitable; add to the unsized pulp. Burlap: Suitable.

DISCHARGING: Discharges a cream shade with tin crystals and zinc dust.

COMPETING PRODUCTS: Made in the United States by Noil Chemical & Color Works and American Aniline Products, Inc.

DIAMINOGEN

(Schultz No. 274)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton.

USUAL METHOD OF DYEING: Direct with salt, or diazotized and developed.

SHADE: Direct, a gray blue.

SHADE BY GASLIGHT: No change.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Fast when developed.
Alkali: Fast when developed.
Chlorine: Color destroyed.
Cross-Dyeing: Fast when developed.
Ironing: Very good; recommended to stand vulcanizing.
Light: Good fastness when developed and coppered.
Perspiration:. Fast when developed.
Rubbing: Fast.
Washing: Fast when developed.
Water: Does not bleed in cold water.

SENSITIVE TO METALS, LIME: Sensitive to copper.

MACHINE DYEING: Suitable.

OTHER PROPERTIES: Suitable for coloring cloth in the starch mangle. Suitable for pad dyeing.

DYED BY OTHER METHODS: The undeveloped shades are of no value. Ammonia strips the color, and dilute mineral acids turn the shade red.

ON UNIONS: Dyes cotton darker than the wool in cotton-wool unions. Dyes the cotton darker than the silk in silk-cotton unions.

ON OTHER MATERIALS: Silk: Dyes with acetic acid direct. Fairly fast to water and washing.

DISCHARGING: Discharges a good white with tin crystals; also with zinc dust or hydrosulphite. Can also be discharged by oxidation.

REMARKS: Developed with 2 per cent soda at 100: Lighter and more violet. Developed with metaphenyline diamine: Deep black; fast to washing and cross-dyeing. Developed with beta-naphthol: Reddish dark blue; fast to washing and cross-dyeing. Developed with beta-naphthol and coppered: Very fast to light and redder.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.

DIAMOND BLACK

(Schultz No. 275)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool on yarn and pieces.

USUAL METHOD OF DYEING: Top chrome (use very little acid and very little chrome).

SHADE: Black, of very good covering power.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Good.

LEVEL: As a black on yarn, very good.

EXHAUSTS: Well.

FASTNESS TO:

Acid: Fast.
Alkali: Fast.
Carbonizing: Fast.
Cross-Dyeing: Fast; will stand cross-dyeing.
Fulling: Tints cotton slightly; leaves wool white.
Light: Fast enough for men's wear.
Perspiration: Fast.
Potting: Bleeds; inferior to Diamond Black PV.
Rubbing: Fast.
Scouring: Fast; white cotton is stained.
Steaming: Fairly fast; shade somewhat greener.
Street Dirt: Fast.
Sulphur: Fast to stoving.
Washing: Stains white cotton.

SENSITIVE TO METALS, LIME: Sensitive to copper; the shade is redder. Not sensitive to iron.

MACHINE DYEING: Suitable for Klauder-Weldon and Franklin Process machines.

OTHER PROPERTIES: An excess of chrome in top-chroming makes the shade greenish and dull.

DYED BY OTHER METHODS: Dyed neutral, the wool is very light.

ON UNIONS: Dyed top chrome: Cotton-effect threads are stained. Dyed top chrome: Silk-effect threads are stained redder than the wool.

ON OTHER MATERIALS: Silk (top chrome): Fast to light, washing and alkalies.

PRINTING: Suitable for piece and vigoureux printing.

DISCHARGING: One per cent sulphoxalate discharges the color.

COMPETING PRODUCTS: Made in the United States by Croton Color & Chemical Company; E. I. du Pont de Nemours & Co.; National Aniline & Chemical Company; New England Aniline Works (Selling Agents, U. S. Color & Chemical Company); American Aniline Products, Inc.; Newport Chemical Works; Amalgamated Dyestuff & Chemical Works.

DIAMOND GREEN

(Schultz No. 276)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool and cotton and wool unions.

USUAL METHOD OF DYEING: Acetic and Glauber salt. Exhaust with sulphuric, like Diamond Black.

SHADE: Dull green.

SHADE BY GASLIGHT: Blacker.

SOLUBILITY: Good.

LEVEL: Dyes level.

EXHAUSTS: Well with sulphuric acid.

FASTNESS TO:

Acid: Shade is not altered by 5 per cent sulphuric acid.
Alkali: Shade goes a little bluer with ammonia.
Carbonizing: Fast.
Fulling: Good; the shade goes slightly bluer and bleeds into white cotton.
Ironing: Fast.
Light: Fair; goes duller. Faster to light on chrome mordant.
Perspiration: Fast.
Potting: Not fast; bleeds.
Rubbing: Fast.
Scouring: Bleeds into white cotton and shade is bluer.
Steaming: Shade goes duller and yellower.
Sulphur: Fast.
Washing: Fast.

SENSITIVE TO METALS, LIME: Sensitive to copper.

OTHER PROPERTIES: Used in combination shades for silk-white effects.

DYED BY OTHER METHODS: Dyed chrome mordant, the shade is much bluer and not as fast to carbonizing, fulling or potting, but is faster to light. Dyed by the silk-white process, the silk is left nearly white. Dyed chromate, the color is weak and does not dye level.

ON UNIONS: Cotton-wool unions: Dyed top chrome, the cotton is left white. Wool-silk: Top-chromed in same bath, the silk is stained a little.

ON OTHER MATERIALS: Dyed on slubbing with fluoride of chrome, the color is fairly fast to fulling and potting. Silk: Color goes on well with acetic acid.

PRINTING: Adapted for printing on slubbing with acid.

DISCHARGING: Does not give a good white with sulphoxalates.

COMPETING PRODUCTS: Made in the United States by E. I. du Pont de Nemours & Co.; Amalgamated Dyestuff & Chemical Works; New England Aniline Works (Selling Agents, U. S. Color & Chemical Company).

Technical Notes from Foreign Sources

Absorption of Water by Cotton

Determinations were made of the moisture regain of raw cotton (American Upland Silver) and pure cellulose (the same cotton kiered for a period of ten hours at a pressure of forty pounds in a caustic soda solution of initial and final concentrations of 1.70 and 1.2 per cent, respectively, and its purity shown by determinations of its copper number viscosity). The samples were exposed over a period of not less than three weeks, and when high humidity conditions prevailed it was found that two months were required. The exposure was conducted in sealed bottles in an atmosphere the humidity of which was determined by the strength of sulphuric acid that was present.

Two series of samples (0.4 and 0.7 gram) of each cotton were employed, one being initially dried at a temperature of 110 deg. Cent., and the other at a temperature of 15 deg. Cent. in a vacuum over phosphorous pentoxide, and changes of weight greater than 0.0003 gram were regarded as significant. The values of the moisture regain are divided into two groups according as they were obtained by moving the cotton samples from an atmosphere of less to one of greater humidity, or by the reverse process.

Raw cotton which was dried at a temperature of 110 deg. Cent. suffers a greater loss of weight (7.20 per cent) than that dried at 15 deg. Cent. (6.25 per cent), and since this difference is not shown by soda-boiled cotton, it is suggested that it is due to the loss of some constituent of the non-cellulosic impurities of the raw cotton at the higher temperature of drying. When cotton is exposed to an atmosphere of given temperature and humidity, there are at least two possible values of the moisture regain, for when a sample of cotton loses water in order to attain equilibrium with an atmosphere, its water content after the attainment of equilibrium is greater than that of a sample which gains water in order to attain equilibrium in the same atmosphere. This hysteresis is greater for soda boiled cotton than for raw cotton, and for one gram of the former an hysteresis of about 0.03 per cent of moisture was observed.

For further details refer to the Journal of the Textile Institute, 1924, pages 138-147T.

Improving Vegetable Fibers

The swelling action of concentrated mineral acids, particularly sulphuric acid on cotton fabrics, by which wool-like, transparent and linen effects are obtained, is considerably modified by the presence of a heterocyclic base, such as pyridine or quinoline, so that the action may be prolonged 50 times without hydrolytic degradation of the cellulose occurring.

For example, bleached mercerized muslin is rendered transparent and soft in handle by treatment for 4 minutes with a mixture of 1 part of pydridine and 4 parts of 66 deg. Be. sulphuric acid (density 1.84), and a wool-like effect is produced on suitably mercerized cotton fabric by treating it with a mixture of one part of pyridine and 9 parts of 56.5 deg. Be. sulphuric acid (density 1.66) for a period of 5 minutes. The linen-like effects on cotton obtained by the methods, described in British Patent No. 192,227, may be obtained by means of simple treatment of cotton with a mixture of sulphuric acid and a heterocyclic base. British Patent No. 196,298.

Mercerization of Fabrics

The process for the mercerization of fabrics and their finishing which is described in the Moniteur de la Maille, 1924, consists in the common use of alkali solutions and solutions of calcium sulphocyanide for treating the cotton fabrics and depends on the property of calcium sulphocyanide, at a suitable concentration and at high temperature, of dissolving cellulose However, while the use of the sulphocyanide alone gives a fabric with a hard and rough handle, when a mixture of the sulphocyanide and of alkali lye is used together, then a product is obtained with a smooth, soft, lasting luster.

The treatment of the fabric with the sulphocyanide may be carried out either before or after the mercerization of the cotton by means of the alkali lye.

Hence it is possible to work in such a fashion that the fabric is first impregnated with a suitable sulphocyanide solution and then dried or steamed in the moist condition. The process may also be used in the decoration or illumination of fabrics, when the latter are printed or bottomed with a suitable color composition after the usual mercerizing process has been completed. The color baths or pastes employed in these cases consist of a concentrated solution of calcium thiocyanate, and the dyestuff ordinarily used for the purpose with the addition of some suitable thickening agent. It has been found convenient to use a solution of cellulose in a sulphocyanide, such as calcium sulphocyanide, as a thickening agent. The use of such a reagent appears to enhance the lasting qualities of the color, and the local color effects produced by it on the fabric. After the fabric has been steamed, washed and dried, it is then mercerized again by means of an alkali.

Another method of carrying out this process is as follows: Protective resists are printed on the fabric, in this case either before or after the mercerizing process has been completed. The concentration of the

solution of calcium sulphocyanide in this case is maintained at such a point that the solution will boil at a temperature between 128 and 150 deg. Cent., and the process itself is carried out at a temperature between 90 and 130 deg. Cent. The time required to bring out the desired effects is in general only about seven to ten seconds, and in no cases must it be any greater than one minute. Otherwise the fabric will be injured by the strong solutions used in the process.

Printing Fabrics with Sulphur Dyestuffs

A satisfactory reducing agent for use in printing pastes containing sulphur dyestuffs consists of a mixture of sodium hydrosulphite, sodium thiosulphate and sodium hydroxide, which react during the usual steaming process to form sodium sulphide. The reaction is as follows:

$$Na_2S_2O_4 + Na_2S_2O_3 + 4NaOH = 3Na_2SO_3 + Na_2S + 2H_2O.$$

For example, a suitable printing paste is prepared by heating to a temperature of 50 to 60 deg. Cent. a mixture containing 100 parts of pyrogene indigo, 300 parts of sodium hydroxide, of 50 deg. Be. concentration (density 1.53), 240 parts of formaldehyde-hydrosulphite (a mixture containing sodium formaldehyde-sulphoxylate), 104 parts of sodium thiosulphate and 106 parts of water. To this there are added, after cooling, 150 parts of a 60 per cent solution of British gum. After printing the fabric is partially dried, steamed for a period of 3 to 4 minutes at a temperature of 100 to 102 deg. Cent. in a Mather-Platt machine and after-treated in the usual manner.

For further details see Chemie et Industrie, Special Number, 1924, 435-7.

Dyeing Cellulose Acetate

Dyestuffs of the aryl or substituted aryl-benzo or naphthoquinonemonoimide series (indophenols) are used for dyeing material consisting of or containing cellulose acetate fibers. The dyestuffs may be applied to the material as their leuco compounds, which are subsequently oxidized to the dyestuffs by air or by treatment with oxidizing agents such as hypochlorites and peroxides, or they may be applied by any suitable method.

For example, the dyestuff is reduced by the addition of 2 kilograms of sodium hydrosulphite to a bath containing 1 kilogram of sodium hydroxide and 1 kilogram of dimethyl para phenyl 1-4 naphthoquinonemonoimide maintained at a temperature of 60 deg. Cent. When reduction is complete, the solution is filtered into a solution at a temperature of 50 deg. cent. containing half a gram of sodium hydrosulphite and 2 c.c. of 20 per cent ammonia per liter, the volume of the bath being about 30 to 1, calculated on the weight of the material being treated therein. The material, 100 kilograms of cellulose acetate yarn in hanks, is worked in the bath for a period of 1½ hours, rinsed in cold water, and oxidized by treatment for half an hour in a bath at a temperature of 40 deg. Cent., containing 2 grams of sodium perborate per liter.

For further details see British Patent No. 220,505.

Indigsol DH in Printing and Dyeing

Indigosol DH is the disodium salt of the disulphuric acid ester of indigo. This substance is easily soluble in water and is not hydrolyzed at ordinary temperatures by dilute alkaline solutions. After hydrolysis by means of acids, preferably mineral acids, Indigosol DH is readily oxidized to indigo, especially in the presence of ferric chloride or nitric acid, and this enables Indigosol DH to be used as a satisfactory substitute for indigo in dyeing and printing cotton, wool and silk. In printing cotton, the fabric is printed or padded with a thickened 6 to 10 per cent solution of Indigosol DH, then dried, passed through a developing bath containing per liter 20 to 40 grams of ferric chloride, 20 grams of hydrochloric, sulphuric or nitric acid, and from 0 to 100 grams of salt. After this treatment the sample is washed and dried.

A slightly greener but useful shade is obtained by padding the fabric with a solution which contains from 6 to 10 per cent of Indigosol DH and from 1.2 to 2 per cent of sodium nitrite. The fabric is then dried and developed in a 2 per cent solution of sulphuric acid. Satisfactory white and colored reserves may be obtained by the usual methods with formaldehyde-sulphoxylates, sodium thiosulphate, sodium acetate or sodium carbonate. Woolen goods are dyed in indigo shades by immersion for about 1½ hours in a bath which contains 8 per cent of Indigosol DH, 10 per cent of sodium sulphate, 4 per cent of acetic acid, and 3 per cent of formic acid. The treatment is carried out at a temperature of from 70 to 100 deg. Cent. The fabric is then washed and developed in a cold bath which contains about 2 per cent of sodium nitrite and from 1 to 2 per cent of sulphuric acid.

For further details see Chemie et Industrie, May, 1924, pages 455 to 460.

Fur Dermatitis

An epidemic of dermatitis prevalent during the winters of 1922 to 1924 and caused by the wearing of furs which were made from rabbit skins dyed to resemble beaver, is attributed to faulty technic in the process of dyeing by oxidation of meta and paraphenylenediamines. Dyed fur is innocuous if oxidation of the amines is complete, but when the oxidation is incomplete, strongly irritant products, such as quinonediimide are produced, and these are able to cause dermatitis. From the Reports on Public Health and Medical Subjects, Nov. 27, 1924. (London.)

Dyeing and Finishing Yarns

British Patent No. 219,768 is concerned with the dyeing, washing, scouring, bleaching or impregnating

skeins or hanks of yarn, and with an apparatus for carrying out these processes. This machine comprises a vat containing the liquor used in the process, and a movable cage carrying an upper and lower series of horizontal flat tubes, each of which rotates about an horizontal axis. Hanks of yarn are suspended between the upper and lower tubes, being thereby maintained under tension, and during the rotation of the tubes the hanks are displaced upward and downward, while their sides approach and recede from each other.

SULFANTHRENE SCARLET 2B PASTE AND ORANGE R PASTE

E. I. du Pont de Nemours & Co. announce placing on the market Sulfanthrene Scarlet 2B Paste and Sulfanthrene Orange R Paste. The first is similar in shade and properties to Hydron Scarlet BB. It is a bluish scarlet which can be used for self shades, or in combination, and is said to stand severe laundering without change of shade and without bleeding. Its fastness to chlorine, cross-dyeing, perspiration and water is claimed to be very good. Its light fastness is also described as good, but it is not, of course, equal in this respect to the Ponsol colors. This product is also described as very soluble and level dyeing, and should find a good market for dyeing ginghams, dress goods, shirtings and other fabrics where fastness to laundering and washing is the principal requirement. Sulfanthrene Scarlet 2B Paste, it is claimed, is an important color for printers and will prove very suitable for producing bright reds and scarlets.

Sulfanthrene Orange R Paste is similar in shade and properties to Hydron Orange R.

This color when dyed on cotton is said to give bright shades of reddish orange of excellent fastness to washing and chlorine, and its fastness-to-light is described as very good.

Its principal use is for dyeing ginghams and shirtings, where laundering fastness is the main requirement, and also for goods which are to be subsequently bleached in the piece, as this bleaching has very little effect upon the shade.

This color is also claimed to be suitable for calico printing, and for shading Sulfanthrene Scarlet 2B Paste or other similar products, or producing bright shades. It can be used either for direct or discharge printing with equal success.

The solubility, exhaust and level dyeing properties of this color are described as very good. It is said to have very good fastness on silk and should be useful for dyeing silk yarns where a high degree of fastness-to-washing and cross-dyeing is required. It is also suitable for dyeing artificial silk, subject to the usual precautions.

The W. A. Jones Foundry & Machine Company of Chicago announce the publication of two new catalogs, numbers 31 and 32, covering their power transmission machinery, sprocket wheels and chain belting.

AMERICAN COLORS WANTED IN ITALY

One of our subscribers, Emanuele Turin, 5 Via Parini, Torino, Italy, advises us that he is interested in securing Italian representation for American manufacturers of aniline colors and allied chemicals. He is prepared to furnish satisfactory references to all interested parties.

Chemical exports in October reached the year's peak, the Chemical Division of the Commerce Department announced following an analysis of the foreign trade statistics for the month. Exports also were 14 per cent higher than in the corresponding month of last year, reaching a total of $13,393,633. Imports of chemicals and allied products are declining. The total for October was 8 per cent less than last year.

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Young man, graduate in chemistry of the German Polytechnic at Karlsruhe, and having had several months' experience in the application laboratories of Fried. Bayer & Co. at Leverkusen, seeks an opportunity to enter a dyehouse as second hand or helper where he may have an opportunity to familiarize himself with American methods. Address Box 277, American Dyestuff Reporter.

STENOGRAPHER

Young woman, experienced as a stenographer in correspondence covering dyestuff, textile and allied subjects, seeks a position in or near New York City. Excellent references. Salary $22.00. Address Box 270, American Dyestuff Reporter.

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Position wanted as superintendent of piece dyeing by man of twenty years' experience on cotton and silk and all classes of cotton piece dyeing. Has had charge of very large plants. Available at once. Address replies to Box 281, American Dyestuff Reporter

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Copies of the American Dyestuff Reporter for August 13, 1923. We shall be glad to pay for all copies received. Mail to Howes Publishing Company, 90 William Street, New York City.

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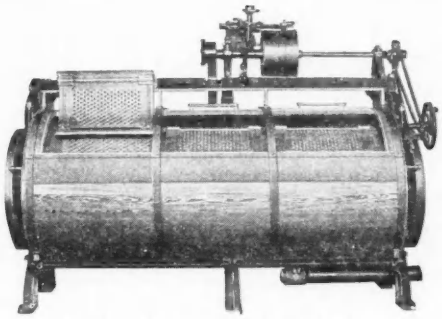
This Year Book also contains the Standard Methods of Determining the Fastness of Dyestuffs on Dyed Silk and Wool and Dyed and Printed Cotton. The tests are given for determining the fastness of dyes to laundry and mill washing, fulling, scouring and other agencies for each of these fibers. The methods of making the fastness tests on each kind of fiber for each class of fastness are described fully. The dyes and the washing and fulling formulas used in each test are given.

The book also includes the detailed reports of the Sub-Committees on Fastness to Perspiration and Fastness to Light and of the Research Committee—each of which contains technical material valuable to anyone concerned with the testing and application of dyestuffs.

Copies of this volume may be obtained at $3 per copy from the Secretary of the Association, Walter E. Hadley, 5 Mountain Ave., Maplewood, N. J.



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